THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVII. No. 1989.] LONDON, JUNE 25, 1901. [53RD YEAR. PRICE 6d.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— LIMITED. —

1, FENCHURCH AVENUE, LONDON, E.C.

GAS AND WATER PIPES

1½ to 12 in. BORE.

THOMAS ALLAN & SONS, LIMITED,

Bonlea Foundry,

THORNABY-ON-TEES.

Formerly Springbank Iron-Works, Glasgow.

ESTABLISHED 1848.

Also Manufacturers of

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

Telegrams: "BONLEA, THORNABY-ON-TEES."

PARKER & LESTER,

Manufacturers & Contractors.

GAS-LEAK INDICATOR.

For Particulars and Price apply to

ORMSIDE STREET, LONDON, S.E.

ESTABLISHED 1830.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

NORTON'S PATENT

"ABYSSINIAN" & ARTESIAN TUBE WELLS,

FOR TOWN WATER-WORKS AND OTHER SUPPLIES.

The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

LE GRAND & SUTCLIFF,

HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

EVERYONE IS SAYING——

"If you want to see the Most Successful Destructor and Electric Light and Traction Installation

"GO TO DARWEN."

For Full Particulars apply to

MELDRUM BROTHERS, LIMITED,

ATLANTIC WORKS, MANCHESTER;

And 66, VICTORIA STREET, WESTMINSTER, where a complete Model may be seen.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

EDWARD COCKEY & SONS, Ld.

MANUFACTURERS OF **PURIFIERS** OF ALL SIZES,

With Improved Centre-Valves, to work either One, Two, Three, or Four Purifiers at one time.

SLIDE VALVES.

SCREW VALVES.

SEAL-REGULATING VALVES.

GASHOLDER VALVES.

FOUR-WAY VALVES.

DISC VALVES.

SELF-ACTING BYE-PASS VALVES.

COMPENSATING VALVES.

UNSOLICITED TESTIMONIAL.

"March 3, 1899.

"Some years ago you made an 18-inch double covered valve for Purifiers delivered to our Works. We are likely to want another for this Station; how soon could you supply it, and what would the price be delivered here? The first one which you made for me, above 30 years ago, is still in excellent working order."

Hand-Power LIFTS, suitable for weights up to 10 Tons.

Hydraulic Power GOLIATHS, suitable for any Weights.

Improved WOOD GRIDS for Purifiers and Scrubbers.

SPECIFICATIONS AND PRICES ON APPLICATION TO—

THE IRON-WORKS, FROME, SOMERSET.

Telegrams: "COCKEYS, FROME." London Agents: Messrs. BALE & HARDY, Bridge House, 181, Queen Victoria St., E.C. Telegrams: "DAMPER, LONDON."

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

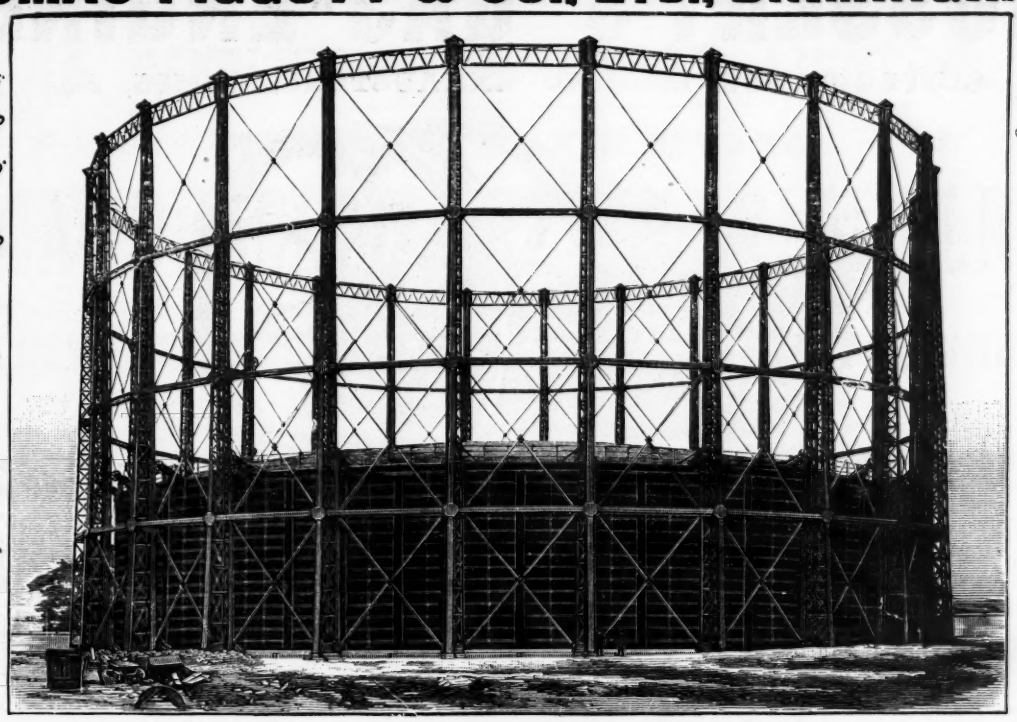
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 193, Southwark Street. MANCHESTER: 33, King Street West. BIRMINGHAM: 114, Colmore Row. LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS

MANUFACTURERS OF

Humphreys & Glasgow's Patent Carburetted Water-Gas Plant.

INSTALLATIONS HAVE ALREADY BEEN SUPPLIED, AND ARE IN HAND FOR THE FOLLOWING GAS-WORKS:—

COPENHAGEN
BELFAST
BRUSSELS
LIVERPOOL
TOTTENHAM
SWANSEA
MANCHESTER
BRIGHTON
PRESTON
SOUTHPORT
BATH
HOYLAKE
COVENTRY
WINCHESTER
SHANGHAI
STOCKPORT
NORWICH
LEA BRIDGE
DUNEDIN (N.Z.)
HULL
STAINES
EDINBURGH
GOSPORT
STAFFORD
STOCKTON-ON-TEES
TUNBRIDGE WELLS
GUILDFORD
COMMERCIAL GAS CO.
BRIDLINGTON
MIDDLESBROUGH
CROYDON
L. & N.W. RY., CREWE
TAUNTON
ROTTERDAM
DORKING
G.L.&C. CO., BROMLEY
DURHAM
SCARBOROUGH
PERTH (W.A.)
BREMEN
LINCOLN
LONGTON
COLNEY HATCH
SYDNEY (Harbour)
SYDNEY (Mortlake)
ANTWERP
BIRMINGHAM
HEBDEN BRIDGE
MAIDENHEAD
EPSOM
NORTH MIDDLESEX
WANDSWORTH
AARHUS
FALMOUTH
SOUTHAMPTON
HARTLEPOOL
UTRECHT
DEVENTER
PORTSMOUTH
BOURNEMOUTH
AYLESBURY
HAMBURG
DUBLIN
REDHILL
FAVERSHAM
CHORLEY
LIÉGE
BRENTFORD
WALTHAM
THE HAGUE
ROMFORD
CARLISLE

REPEATED CONTRACTS.

TOTTENHAM (2nd)
TOTTENHAM (3rd)

REPEATED CONTRACTS.

TOTTENHAM (4th)
COPENHAGEN
BELFAST
BRUSSELS (2nd)
BRUSSELS (3rd)
BRUSSELS (4th)
LIVERPOOL
COVENTRY
LEA BRIDGE
MAIDENHEAD
COMMERCIAL (2nd)
COMMERCIAL (3rd)
COMMERCIAL (4th)
G.L. & C. CO., NINE ELMS
G.L. & C. CO., BECKTON
G.L. & C. CO., BECKTON (2nd)
G.L. & C. CO., FULHAM
BRIGHTON
STOCKPORT
CROYDON
MANCHESTER
DUBLIN
SOUTHAMPTON
BRIDLINGTON
SWANSEA (2nd)

THE WIGAN COAL & IRON CO., LIMTD.,

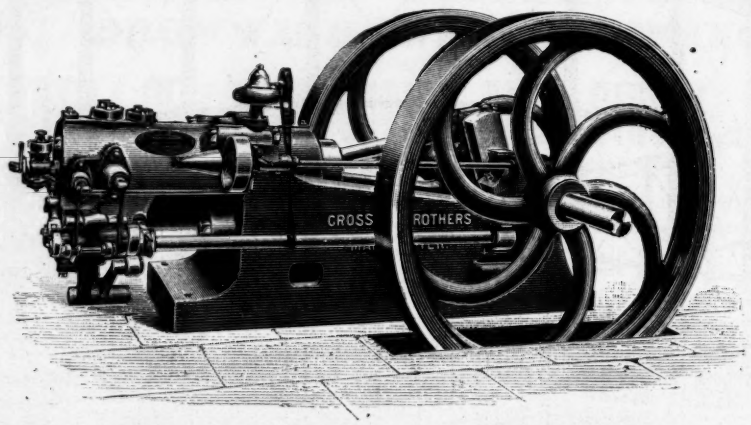
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland and West of England District Office: 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.
Telegraphic Address: "PARKER, LONDON."

CROSSLEY'S GAS-ENGINES

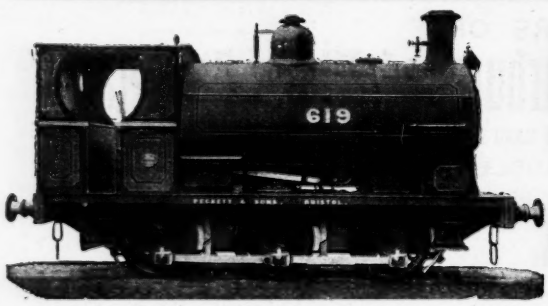
SUITABLE FOR DRIVING EXHAUSTERS, PUMPS, &c.



Represents "U" Type giving 32 Effective Horse Power.

Large Number of Second-Hand Engines always in Stock.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c Locomotives of various Sizes always in Stock, ready for Immediate Delivery.

Photographs, Specifications, and Prices on Application.

PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

Telegraphic Address: "PECKETT, BRISTOL."

NEWTON, CHAMBERS, & CO.,

LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

Established 1790

LONDON OFFICE: 19, Great George Street, WESTMINSTER.

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

Manufacturers of every description of

PLANT, APPARATUS, and MACHINERY for GAS and CHEMICAL WORKS.

RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

CONDENSERS, SCRUBBERS, and WASHERS.

PURIFIERS with Planed Joints a Speciality.

Patent CENTRE-VALVES, RACK and SCREW VALVES, WOOD GRIDS, and SCRUBBER-BOARDS, CAST-IRON MAINS, and SPECIALS.

STRUCTURAL WORK, COLUMNS, GIRDERS, and ROOFING.

GASHOLDERS, Cast-Iron or Steel Tanks.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (Special Quality) for Engine Cylinders. GAS COAL famous for its UNRIVALLED EXCELLENCE.

"In future the two great illuminators will be called—one the 'Sun,' and the other, to earmark it from its competitor, the 'Kitson.'"—*From "PUNCH," May 27th, 1901.*

A REVOLUTION IN STREET LIGHTING.

THE KITSON

INCANDESCENT PETROLEUM LIGHT

IS THE

CHEAPEST & MOST BRILLIANT SYSTEM OF STREET LIGHTING

THAT HAS YET BEEN PRODUCED.

It can be seen on Portland Place, lighting the street from the Langham Hotel to Park Crescent.

IT AVOIDS THE NUISANCE OF TEARING UP THE STREETS.

A Committee of the Aberdeen Town Council, in a recent Report, made the following statement:—

"We may at once say that no comparison can be made between the Kitson Light and ordinary or "Incandescent, Gas Lighting, as these are completely put into the shade by the Petroleum Light, and, "comparing it with Electric Lighting, it is very much superior both as to brilliancy and cost."

Before expending enormous sums in Electric Lighting, it would be worth while to investigate this System.

For Particulars apply to—

THE KITSON LIGHTING AND HEATING SYNDICATE, LIMITED,

1, VICTORIA EMBANKMENT, Blackfriars, LONDON, E.C.

The LEEDS FIRECLAY CO., LD.,

Telegrams: "SETTINGS, LEEDS." Telephone: No. 1332.

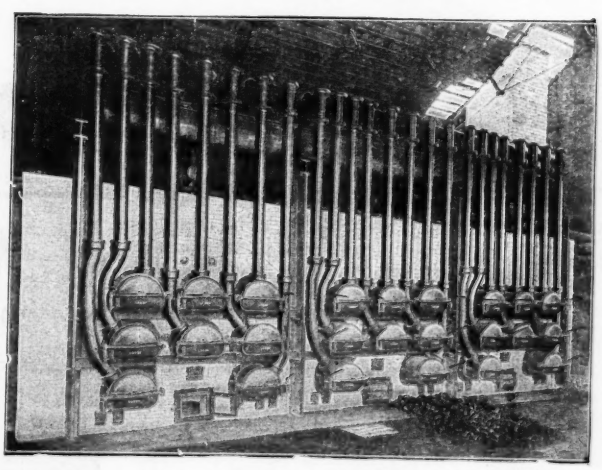
WORTLEY, LEEDS.

ENGINEERING DEPARTMENT

RETORT

INCLINED,
HORIZONTAL,
REGENERATOR,
GENERATOR,
AND
DIRECT FIRED.

RETORTS RE-SET.



SETTINGS

SHALLOW REGENERATORS A SPECIALITY.

NUMEROUS TESTIMONIALS.

GUARANTEED RESULTS EXCEEDED IN MOST INSTANCES.

SOLE MAKERS OF HUDSON & RANN'S PATENT AUTOMATIC CHIMNEY DRAUGHT REGULATOR.

MOUTHPIECES, WITH SELF-SEALING OR LUTED LIDS.

BENCH, FURNACE, AND FLOOR IRONWORK ROOFS.

CONDENSERS, WASHERS, SCRUBBERS.
PURIFIERS, GASHOLDERS, &c.

COAL & COKE BREAKING, ELEVATING, & CONVEYING MACHINERY.

— CONTRACTORS FOR COMPLETE GAS-WORKS. —

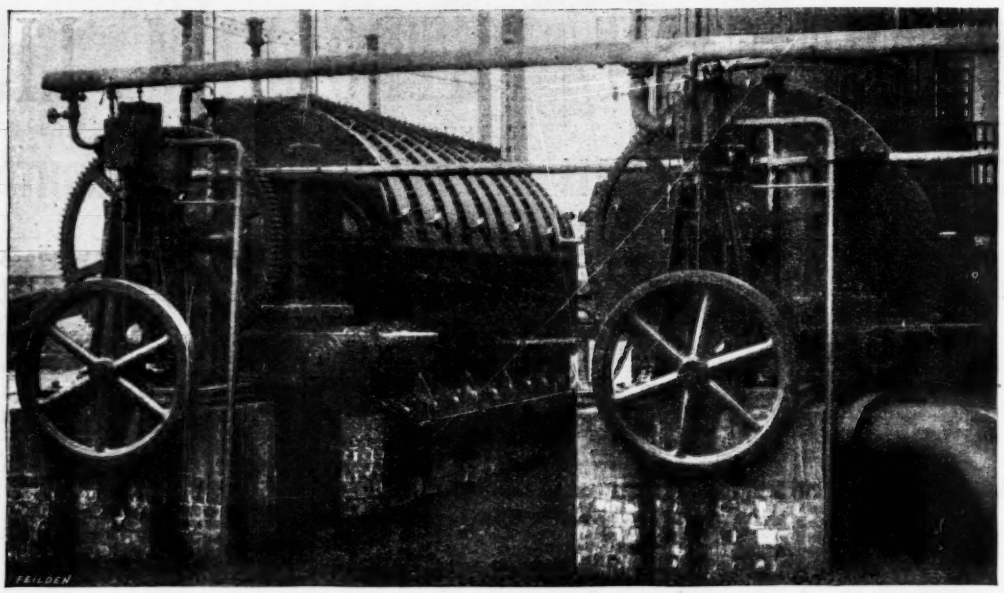
642,000,000

Cubic Feet of Gas per day are now being Purified by

PATENT "STANDARD" WASHER-SCRUBBERS

which extract ALL the Ammonia and a large proportion of the CO_2 and H_2S.

Prevention of Slip of Gas Unwashed.
Strength of Liquor Concentrated.



Maximum Washing Surface.
Easy access to interior.

KIRKHAM, HULETT, & CHANDLER, LD.

PALACE CHAMBERS, BRIDGE ST., WESTMINSTER, S.W.

THE GAS-METER COMPANY,

MANUFACTURERS OF LIMITED.

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.

STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM (Late WEST & GREGSON). Established 1830.

For Prices and Particulars app'y to

F. W. CHURCH, Secretary.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

[See Advertisement on back of Wrapper.

"CANNON" SLOT COOKERS.

THE "VILLA."

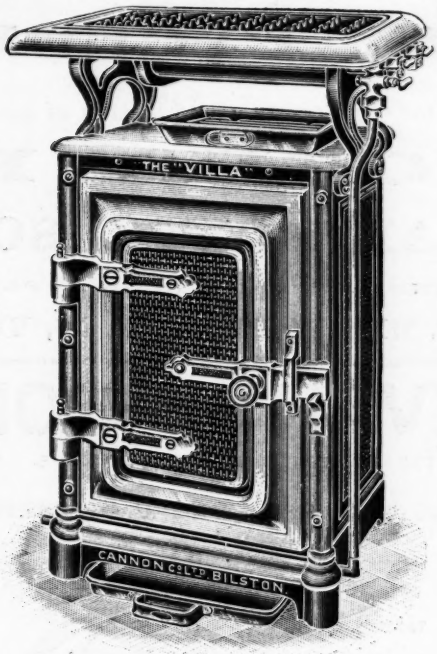
IN TWO SIZES.

OVENS:

12 x 12 x 19 inches

AND

14 x 12 x 19 inches.



THE "VILLA."

IN GREAT DEMAND.

PROMPT DELIVERY GUARANTEED.

A LARGE VARIETY OF OTHER PATTERNS AND SIZES. SPECIAL QUOTATIONS FOR QUANTITIES.

CANNON IRON FOUNDRIES,
Gas-Stove Department. LIMITED,

Head Office and Works: DEEPFIELDS, NEAR BILSTON, STAFFS.

London Office and Show-Room: BATH HOUSE, 57-60, HOLBORN VIADUCT, E.C.

THE MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER 100 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past **Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

HENRY BALFOUR & CO., LTD.,

LEVEN, FIFESHIRE.

Contractors for the Supply and Erection of all Classes of

GAS-WORKS PLANT.

MECHANICAL BRUSH SCRUBBERS.

PRICES AND PARTICULARS ON APPLICATION.

London Representative: MR. HENRY PUPLETT, 47, VICTORIA STREET, S.W.

JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

Telegrams: "Evans, Wolverhampton." PLEASE APPLY FOR CATALOGUE No. 8. National Telephone No. 7089.

12,000 PUMPS IN STOCK AND PROGRESS.

TRADE MARK.

NO TAPPETS.

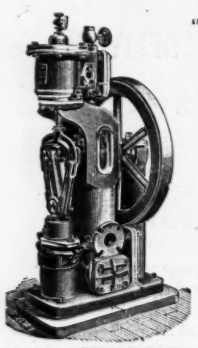


Fig. 705. "SINGLE RAM" STEAM-PUMP.

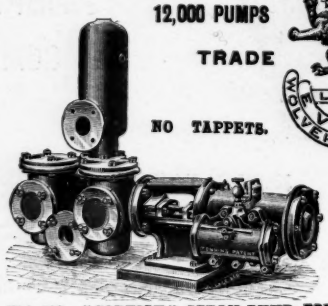


Fig. 808. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

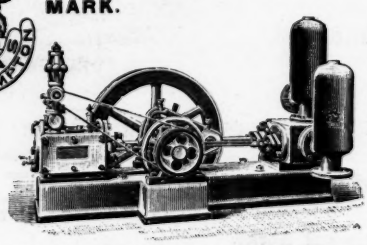


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

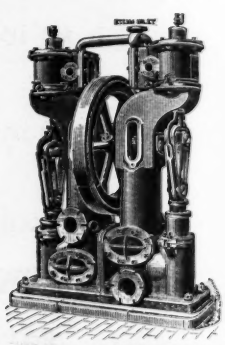


Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

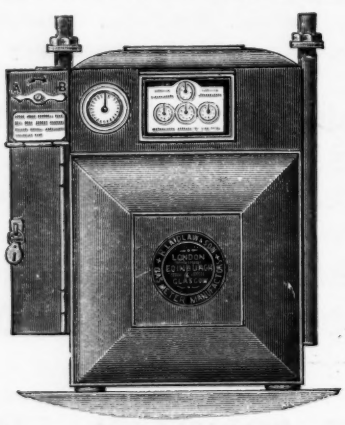
R. LAIDLAW & SON

GAS & WATER ENGINEERS.

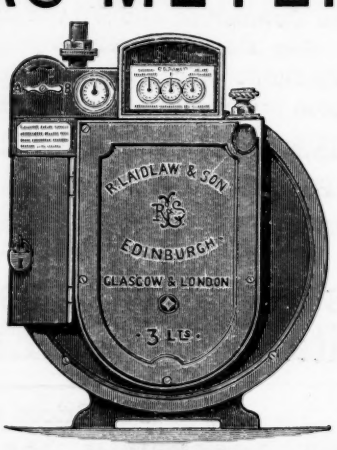
MANUFACTURERS OF WET & DRY GAS-METERS,

SIEMENS WATER-METERS,

PREPAYMENT GAS-METERS.



—DRY METER.—



—WET METER.—

EDINBURGH: SIMON SQUARE WORKS. | GLASGOW: ALLIANCE FOUNDRY. | LONDON: 6, LITTLE BUSH LANE

CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
The Need of a Coal Commission . . . 1719
Call for Opposition to the South Metropolitan Bill 1719
Carburetted Water Gas in the British Gas Industry 1720
Great Meeting of Gas Engineers in Vienna 1720
Glasgow Engineering Congress 1720
Combination in the Gas Industry . . . 1721
Electrolysis Again. 1721
Result of the Appeal in the St. Helens Explosion Case 1721
The Mines (Eight Hours) Bill in Committee 1721
English Towns in Pawn 1722
Report of the Local Taxation Commission 1722
WATER AFFAIRS—
Position of the London Companies . . 1722

THE INCORPORATED GAS INSTITUTE.

ANNUAL MEETING IN LONDON—
Papers and Discussions (*concluded*)—
High and Low Pressure Gas Incandescent Lighting. By W. Sugg, of London 1723
Effect of Quality and Pressure of Gas on the Efficiency of Incandescent Gas Lighting, Having Regard to Economy. By Walter Grafton, of Beckton . . 1726
Self-Intensifying of Gas Pressure by Means of Waste Heat. By C. Scott-Snell, of London 1729

ESSAYS AND REVIEWS.

A New View of the Housing of the Poor and Municipal Trading—First Article . . . 1741
Staines Reservoirs Scheme. 1742
Electric Lighting Memoranda 1743
Gas and Water Stock Market 1743

NOTES.

Professor Caldwell on the Electrolysis of Pipes 1744
Benefit of the Export Coal Trade 1745
Krusell Oil Furnace 1745

TECHNICAL RECORD.

Great Gathering of Gas and Water Engineers in Vienna 1745
Southern Gas Engineers at Bournemouth . 1748
Western (U.S.A.) Gas Association . . . 1749
A "Double-Standard" Photometer and a Calorimeter Development 1751

REGISTER OF PATENTS.

Incandescent Mantle Supports—Sugg, W. T. 1752
Compressing Gas and Air—Gore, J. . . . 1752
Liquid-Meters—Barr, J. 1752
Gas-Generators—Gerdes, H. 1753
Patent Notices 1753

CORRESPONDENCE.

Optimism and Pessimism as Tangible Business Factors 1753

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms . . 1754
Progress of Bills 1755

LEGAL INTELLIGENCE.

Supreme Court of Judicature—Court of Appeal—St. Helens Corporation *v.* United Alkali Company, Limited—The St. Helens Explosion 1755
High Court of Justice—King's Bench Division—New River Company *v.* Assessment Committee of the Hertford Union and Others . 1756
Court of Session—Bill Chamber—The Welsbach Patents 1757
Invalidity of the Belgian Welsbach Patents. 1757
Electricity Supply by Gas Companies . . 1758
The Nuisance from the Leyton Electric Light Works 1758
Longford Gas Company and the Irish Provincial Gas Company 1758
Alleged Unauthorized Fixing of Gas Regulators. 1759
Stamping Gas Companies' Agreements . . 1759

MISCELLANEOUS NEWS.

Plymouth and Stonehouse Gas Company—Low Illuminating Power Advocated—Suggested Combination among Gas Companies 1759
Welsbach Incandescent Gas-Light Company—The Directors' Report 1760
Oldham Corporation Gas Undertaking . . 1760
Glasgow Corporation Gas Department—Increases of Engineers' Salaries 1761
Wigan Corporation Gas Supply 1761
Dundee Corporation Gas Undertaking . . 1761
Coventry Corporation Gas Accounts . . . 1762
Gas and Electric Lighting at Burton . . . 1762
Burslem Corporation Gas Accounts . . . 1762

MISCELLANEOUS NEWS (*continued*).

Incandescent Gas *v.* Electricity for Street Lighting 1763
Coal Lighterage on the Thames 1763
Cork Gas Strike and Explosion 1763
Electric Tramways and Electrolysis . . . 1764
Large Electric Power Station on Tyneside . 1764
Electric Lighting Notes 1764
Glasgow Corporation Water Supply . . . 1765
Chelsea Water-Works Company 1765
Notes from Scotland 1766
Current Sales of Gas Products 1767
Coal Trade Reports 1767

PARAGRAPHS.

Wooden Stave Pipe 1723
Moorland Waters—Gas-Engine Handbook . 1741
Removal of the Gas Institute Offices . . . 1742
Freezing of the Water in the Scott-Snell Lamp 1743
Personal and Obituary 1744
Exemption of Gas-Fittings on Hire from Distress—Ripon Gas Supply 1755
Leeds Water Profits—Waste Water from Industrial Centres — Burnham (Somerset) Water Supply 1759
The Peoria Electrolysis Litigation . . . 1765
New Reservoir for Rochdale—Sales of Shares and Stock 1768
Gas Explosion in Barcelona — Lighting, Meter, and Gas Apparatus Company—Extensions at the Kendal Gas-Works—Swindon Water Supply—The Coal Export Duty—London County Council and Subways—Billing's Burner Syndicate in Liquidation 1769
Queenstown Water Supply—Suggested Purchase of the Abercarn Gas-Works by the District Council—New Gasholder at Maidstone—Derwent Valley Water Board—Wigton District Council and the Gas-Works—Northam Water-Works—Suffocations by Gas 1770
New Joint-Stock Companies—The Swansea Reservoir Contract—Carlisle Gas Committee and their Workmen—Tonbridge Water Company—Coventry Water-Works Profits—Acetylene Lighting of French Towns—Carlisle New Water Scheme . . 1771
Littlehampton Water Supply—Public Lighting at Launceston 1772

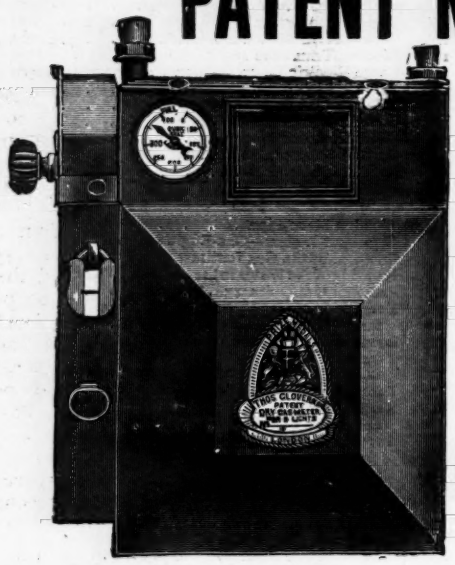
Messrs. HUMPHREYS & GLASGOW

CARBURETTED WATER-GAS PLANT.

38, VICTORIA STREET,
LONDON, S.W.
Telegrams "EPISTOLARY, LONDON."

UNITED STATES OFFICE:
BANK OF COMMERCE BUILDING,
NEW YORK.

THOMAS GLOVER & CO.'S
PATENT NEW IMPROVED
PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

THOMAS GLOVER & CO., LTD.,
DRY GAS-METER MANUFACTURERS,
214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 38, BATH STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 1068.

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address:* "GOTHIC"

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 3398.

GLASGOW: 69-71 McALPINE STREET. *Telegraphic Address:* "GASMAIN." Telephone No. 6107.

PARKINSON AND W. & B. COWAN, LTD.
(PARKINSON BRANCH.)

DRY METERS

OF THE VERY BEST QUALITY.

ALL SIZES KEPT IN STOCK.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegrams: "INDEX."
Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegrams: "GASMETERS."
Telephone No. 1101.
[See also Advt. on last White Page.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

VOL. LXXVII., No. 1989.——TUESDAY, JUNE 25, 1901.

EDITORIAL NOTES.

The Need of a Coal Commission.

It is to be hoped that the report published in the "Newcastle "Leader"—the organ of one of our principal coalowners, Sir James Joicey—to the effect that Sir Michael Hicks-Beach contemplates proposing the appointment of a Commission to inquire into the whole question of the coal resources of this country, will prove true, and that such an inquiry will be instituted in the near future. The advisability of appointing a Committee (or, if it be deemed necessary, a Royal Commission) to revise and supplement the report of the Commission, presided over by the late Duke of Argyll, which concluded its labours in 1871, has been frequently urged in these columns. Such a course—first rendered advisable by the recent high price of coal—is more than ever called for since the policy of imposing a duty upon exports of coal has been adopted. The general public, and the papers that are supposed to inform it, have such hazy and often erroneous notions on the various aspects of the coal question, that an official statement of the facts and figures concerning the coal trade, both home and foreign, should be of much value.

The Commission, if appointed, should be instructed to report upon the estimated quantity of coal remaining in our mines, and especially as to the proportion of the estimated quantity which is to be found in seams that can be worked at a moderate cost. Coal which lies so deep, or in such thin seams, as to cost, even at the lowest rates of wages, say 10s. per ton to bring to bank, will not be of much use to our manufacturers when competing with countries bringing coal to the pit's head at 5s. or less per ton. The report would naturally contain also an estimate as to the probable duration of our coal resources, though the value to be placed upon all such estimates is not perhaps very great. So few years suffice to change the conditions of industrial life—to increase or to diminish the demand for coal as motive power—that any estimate founded upon existing conditions may easily be rendered completely obsolete and useless by the efflux of but a small proportion of the years comprised in the estimate. The example of Jevons is sufficient demonstration of that fact.

The Commission would further have to inquire into the possibility of adopting more economical means (1) of raising coal, with special reference to the use of coal-cutting machinery in place of hand labour; and (2) of using coal, in order that a larger proportion of the potential power may be utilized than at present. The waste of energy that takes place annually in the "consumption" of the 170 million tons of coal used in this country, is simply appalling. Finally—if it be right to put the main cause of the Commission's creation last, which we do because our foreign coal trade is only one-fourth in bulk of our home consumption—the inquiry would cover the questions involved in the exportation of coal and in the imposition of a tax upon the quantities exported. The Commission would have to consider the relative value of British coals of various qualities compared, first with those procurable in the countries to which we at present export, and second with the coals of other producing countries which might be imported by our customers were the cost of British coal materially raised. For this purpose, the freight question would, of necessity, be considered. The problem of retaining adequate quantities of first-class steam coals for our Navy would naturally also receive attention in connection with the question of coal exports.

There is, then, ample scope for an expert and energetic Commission's labours; and the more speedily they are begun, and completed, the better. For the public will probably, before a very great period of time has elapsed, be in need of all the authentic information obtainable regarding the coal trade, and the importance of cheaply wrought coal to our industries, when they are once more called upon to extend sympathy and material assistance to coal miners on strike against a reduction in their wages. As was said last week, there is no immediate prospect of such a strike; but that it will come in the comparatively near future we are afraid there is only too good reason to believe. The spirit animating the speeches made and the resolutions passed at the annual demonstration of the Yorkshire Miners' Association, held at Dewsbury yesterday week, certainly confirms that opinion. Constant reference was made by the speakers to the balance in hand (over £200,000), and to the advisability of "asserting their power"—a temptation that has been the curse of Trade Unionism. The leaders repeatedly urged upon the men the wisdom of doubling their weekly contributions—advice not as yet adopted—"especially as prices were going down, and they "would require all their strength to maintain the 60 per "cent. advance they had secured." If the men seriously intend to fight rather than relinquish in a time of slack trade any part of the increase in wages granted them in consequence of business being abnormally good, we shall not have to wait long for the struggle. But, of course, speaking and hurrahing at an annual demonstration, to the accompaniment of 78 bands, is a different matter from entering in cold blood upon a costly and painful fight. The unfortunate thing is that the leaders who make these belligerent speeches do not always suffer all the ills that result from them.

Call for Opposition to the South Metropolitan Bill.

It is obviously desirable for those eminent personages, the "superior" people of our local government districts, to take an interest in, and do their proper share of, the work of the local authorities. In London, for example, it has always been deplored by thoughtful citizens that most of the arduous and thankless duties of local administration have been permitted, through the abstention of the genteel, to descend upon the shoulders of small shopkeepers and less reputable nonentities. Things are not quite so bad now; the London County Council and some of the new Metropolitan Municipalities having succeeded in attracting to themselves a fair sprinkling of London notables. But something yet remains to be desired in this regard, and that is that these superior people, before engaging in local politics, would take the trouble to acquaint themselves with the merits of passing questions. For lack of this reasonable preparation, Dr. J. Fletcher Little, L.C.C., who hails from the highly superior professional address of Harley Street, W., has allowed himself to write a letter to the London newspapers, in which he advocates opposition to the South Metropolitan Company's Bill. Without deigning to state anything else about the Bill, he declares that "it proposes to transfer a piece of territory "situated south of the Thames from the Gaslight and Coke "Company to the South Metropolitan Gas Company." It is unnecessary to go farther into this remarkable diatribe, inasmuch as those who would have been very pleased to supply the writer with accurate information on the subject could have assured him that the Parliamentary Committee who passed the Bill through the Commons, with their blessing, were particularly careful to prevent it from doing anything of the kind as alleged.

When the residents of Harley Street are so remiss in diagnosing the state of the Metropolis Gas Supply, what is to be expected of persons less habituated to the use of the "scientific method"? It is to be feared that the dissatisfaction with London gas matters generally which Dr. Little experiences will tend to increase rather than to diminish with the passing of time, unless he consents to go through with the prosaic, but indispensable, task of reading up the subject. In one place in his letter, he states that "our "public authorities are not empowered to send a financial "expert to inspect the books of our Gas Company, as in the "case of Liverpool; and the only pressure we can bring to "bear is through keeping down the price for public lighting "on the north side of the Thames to the same level as that "charged to private consumers on the south side." But why this exclusive care for the cost of public lighting in the north? Are not the private gas consumers entitled to some consideration also? The House of Commons Committee thought so, at any rate. The remark about public authorities not having access to the books of the London Gas Companies is not well founded, as the Comptroller of the London County Council could have told Dr. Little. The trouble, where there is any, is not a matter of book-keeping.

Carburetted Water Gas in the British Gas Industry.

THE two papers and the discussion on carburetted water-gas manufacture for British gas-works, which constituted one-half of the technical business at the Gas Institute meeting, were replete with interest. Without traversing all that was so ably written and said on the subject, there are two or three leading considerations which may be stated for the guidance of those students of the technic of gas manufacture who may be at a loss to reconcile the opposing opinions in this regard of competent masters of their profession. In contemplating the promising advantages and the possible drawbacks of alternative ways of arriving at the same general result—in this case, the manufacture of gas—the prudent man will separate in his own mind the direct from the collateral reasons for and against a proposed choice. Those who, like Mr. Robert Porter, of Elland, look at the single point of the cost of carburetted water gas into the holder, have reason for calling it dear. So it is, especially lately; and this is partly the reason why, in this country, there are no exclusively carburetted water-gas works, even for private use. Then, this being true, the inevitable question that follows is, How can so costly a product help to that permanent and progressive cheapening of the price of gas to the consumer which it is the object of all gas undertakings to further by every agency at their command? Frankly, we do not know how this question can be answered in the affirmative; and contributions on the subject will be welcomed for our pages.

It might even be possible to push the assault further on this line, and point out that the most enthusiastic partisans of carburetted water-gas manufacture in this country—as an auxiliary, of course—are not identified with the sale of gas that can be classified as cheap. They make gas of high illuminating power, in most instances; but cheap it is not, as a rule. And they do not appear to be specially anxious to attain eminence of this particular kind. If their apologies for indulging in carburetted water gas to the extent they do are examined, they will be found to be chiefly of a local or collateral nature. It suits them, in their peculiar circumstances. It enables them to put off the evil day when more money must be spent upon storage, which is abhorrent to them for more than one reason. It "takes up the slack" of the work and the men. It enables them to sleep soundly o' nights. And so forth. All good and reasonable pleas, doubtless; but is this the British gas industry? We cannot conscientiously say that it is, while ordinary coal gas costs less everywhere and always—so long, that is to say, as there are no special local conditions to weigh down the balance of advantages on one side.

Far be it from us to challenge the right of a carburetted water-gas plant to any useful place which it can worthily fill in a gas-works. Circumstances, proverbially, alter cases; and where a gas manager is unable to help himself in other ways, such a plant may help him. It cannot be truly said, however, that carburetted water-gas manufacture under normal conditions is making any great technical or economic advance in the United Kingdom. It is still a luxury, a makeshift, a temporary expedient—an auxiliary, in a word, where special obligations upon the undertaking (as in Liverpool) do not exist to make its employment on a large scale practically imperative. Any manufacturing plant of which this can be predicated must be regarded as having a very unstable foundation in the industry to which it belongs. It certainly cannot, in ordinary circumstances, be described as a necessary. Some might go so far as to qualify carburetted water-gas plant as a positive hindrance to gas making to the best advantage, where coal gas occupies its present position, and enjoys the illimitable prospects that it has in Great Britain. These critics might say, if it were not for the "fatal facility" of the gas generator and carburettor—which is the gas manager's short cut to a full holder—who knows what real conquests might be made in the debateable land separating gas, as it is now sold for select uses, from the service-of-all-work which everybody believes the same supply might render to the community, at a price? Since so many of our leading technicians took to carburetted water gas, what advances have they made in their general technic? Why, the dearth of good and fresh papers for reading at the technical societies' meetings might, with a show of reason, be attributed to too free an indulgence in this narcotic. Give a hard-working, much-tried gas maker a thoroughly good carburetted water-gas plant, and often very little more is heard from him! This is much to be regretted, and is certainly not as it should be.

Great Meeting of Gas Engineers in Vienna.

IN the present issue of the "JOURNAL" will be found a special account, supplied by correspondents commissioned by us to attend, of the great meeting of European Gas and Water Works Engineers in Vienna. The scale of this gathering, and the interesting nature of the proceedings, fully justified this enterprise on behalf of "JOURNAL" readers, without which English technicians would have remained in ignorance of these transactions; for no British engineers took part in them. It appears that France was similarly unrepresented; probably for the same reason as that which would keep most Englishmen away—namely, ignorance of the German language. Of all the deplorable results of the confusion of tongues upon the earth, perhaps the worst is the separation which it makes between the English-speaking peoples and their German cousins. It is very remarkable that whereas Englishmen willing to take some pains over the cultivation of their minds, find no great difficulty in at least reading the written language of the French, whose genius is so different from their own, the tremendous obstacle of the German tongue—worse to read even than it is to speak—keeps asunder minds which have very much in common. We feel it incumbent upon us to offer this explanation to the members of the German Association and their good Viennese hosts, for a marked abstention from a gathering which otherwise would certainly have attracted some representative Englishmen. As it is, however, the "JOURNAL" correspondents have been able to catch, for the instruction of their countrymen, all that was specially interesting on this really great occasion.

One feature of the meeting was a lecture by Baron Auer von Welsbach upon his invention of the incandescent gas-light, based upon the characteristic properties of the rare earths which are now familiar to the civilized world. This account, in which the personality of the inventor was very finely revealed, would alone have repaid many for making the pilgrimage to the Austrian Capital. Then there was Dr. Bunte, universally admitted to the degree of Master of the science of the gas industry, who on this occasion talked about explosive gaseous mixtures. Herr W. von Oechelhaeuser dealt effectively with the subject of the supply of gas at differential prices—an old question which modern experiences are again thrusting to the front. Dr. Strache also contributed a paper. Our correspondents were not favourably impressed with the new gas-works of the Municipality of Vienna, concerning which we shall later on have some further particulars to publish.

Glasgow Engineering Congress.

THE arrangements for the Glasgow Engineering Conference are well advanced, and everything points to an assemblage of engineers, and an outpouring of technical matter, such as the British engineering profession, in all its ramifications, has never before witnessed. The Secretaries of the various Sections have been in conference at the Institution of Mechanical Engineers, under the presidency of Mr. James Mansergh; and the reports which they were able to make gave supreme satisfaction. The arrangements have been carried so far along the road that a rough draft programme applying to the Congress as a whole is now possible, and one is in course of preparation for distribution among those who are formulating the plans. We may therefore expect the issue of a complete programme in ample time for engineers intending to be present to prepare themselves for discussing the subjects that will be introduced. Good provision in the way of technical fare has been made for the Gas Section; the Honorary Secretary (Mr. James W. Helps) having busied himself in his usual thorough fashion, to secure contributions both good in quality and of such abundance that there will be no hiatus in the proceedings. As he told the members of the Gas Institute a few days since, the Chairman of the Gas Section (Mr. George Livesey) is going to submit his address for discussion; and we now learn that, in addition, there will be ten papers, all of which will, the authors' names guarantee, be of a really excellent character. As there are only to be morning sittings over three days, there will have to be no waste time, and speakers will need to abstain from verbosity in order that all who desire may obtain a hearing, and that the programme may be completely passed through. Our Continental friends will be well represented—if not numerically by men of distinction among their colleagues. As Mr. Helps stated at the Institute meeting, the Belgian and Swiss engineers will send a good deputation. Then Dr. Bunte only last week

communicated the intelligence that Dr. Leybold has been deputed by his colleagues of the German Gas and Water Association to attend; and he has kindly made himself responsible for a paper. The honour of representing the Société Technique du Gaz en France has been conferred upon M. Cornuault, of Paris. Fraternal greetings will be extended to our Continental visitors—indeed we feel safe in saying that their reception in Glasgow will be of that courteous and dignified character which will testify the appreciation of the British gas profession of their positions as representatives of foreign societies with a record of honourable work.

Combination in the Gas Industry.

THE Chairman of the Plymouth and Stonehouse Gas Company, Mr. J. A. Bellamy, touched upon a subject of much interest in his speech at the annual meeting of the Company last week. "The lack of combination among gas companies" has struck more than one observer; and in the Gas Companies' Protection Association an attempt has been made to meet the deficiency. But, excellent as are the objects of the Association, it does not go far enough on the road indicated by Mr. Bellamy; nor does it attract to itself sufficient notice. Its existence seems to be unknown to the Chairman of the Plymouth Gas Company; and the probability is that the average gas shareholder, whose voting strength it is suggested should be made use of for the benefit of the industry, has never heard of it. In any case, the Association does not come up to the ideal to which Mr. Bellamy gives expression, of an organization which shall not only protect the interests of the gas industry, financially and legally, but shall endow original research and provide means for the trial, on a large and practical scale, of new discoveries. Two distinct lines of procedure are here marked out for the proposed organization. Of these, the second is really the more important. There are occasions upon which it would be an advantage for the gas industry to act in common for the protection of its rights. Such an occasion was presented by the Mond Gas Bill, which, while attacking the interests of gas undertakings in certain districts, really assailed a principle which has guided gas legislation ever since it began to be recognized that competition in the supply of gas was not economical or demanded in the public interest. It is possible, too, that the influence of such an Association might make itself felt in other ways; and that Governments might be inclined to listen with respect to the counsel or remonstrance of a Committee backed up by the votes of the great body of shareholders in gas undertakings.

But, after all, the work which lies ready to the hand of any combination of gas undertakings is that which is connected with the scientific rather than the political side of the industry. Every gas engineer has felt the need of that first-class laboratory which Mr. Bellamy is anxious to see established. Both the time and the means for original research are limited in the case of engineers who have charge of large works; and though very much useful investigation and experiment is done by them, they would all be grateful for the opportunity of referring to a well-equipped laboratory for the solution of some of the endless problems which present themselves in gas-manufacturing practice. New ideas would then make their way more quickly. It is at all times felt that it requires some courage to take up and apply on a working scale a discovery the assured value of which is based upon laboratory experiments alone. It, of course, has to be done, and it is done, though it is not unfrequently the fate of the pioneers to mark the road which should not be trod rather than that which it is safe to follow. There is no reason why these risks should be run by individual companies or engineers for the benefit of the whole industry; and they need not be run if the companies and, for such purposes, the corporations owning gas-works would combine their forces.

Electrolysis Again.

THE question of electrolytic injury by stray electric traction currents to buried pipes was inquired into again on Friday and yesterday, in connection with this year's Bill of the London United Tramways Company. This particular Company are among the most aggressive of the species. Their operations are for the time being confined to the western suburbs of the Metropolis; but their schemes of extension embrace practically the whole of the principal highways of West Middlesex and the adjacent parts of Surrey. This session the Company's Bill has passed Sir John Kennaway's Committee to the extent of permitting the links of tramway to be carried over Kingston and Hampton Court Bridges, greatly to the disgust of many people. It so happens that, in proposing to occupy this district, the Company had to do with the London Water Companies, whose trunk-mains already fill some of the highways from kerb to kerb. Seeing that the bulk of the water supply of London flows through these mains, it was plainly the duty of the owners to ask Parliament to give them most complete assurance of protection. Consequently, this raised the whole question of electrolysis again; and it was all gone into afresh. Professor Silvanus P. Thompson explained the subject, for the promoters, and was supported, in contending for the sufficiency of the Board of Trade regulations, by a number of electricians, including Sir W. H. Preece. Evidence for the Water Companies was directed to show that the Board of Trade regulations are not sufficient to thoroughly protect buried pipes from all risk of electrolytic damage where tramways are worked electrically with return by the metals; but the electric tramway companies continue to show great perseverance in trying to avoid all liability for everything over and above conformity with the official regulations. The point as to whether the Water Companies have a common-law right to recover compensation for, or to proceed for protection against, the commission of damage to their property outside the regulations, was mentioned, but not properly cleared up. It is a layman's opinion, offered with due deference, that, inasmuch as the occupancy of a highway by pipes is a non-natural use thereof, this common-law remedy does not apply.

Result of the Appeal in the St. Helens Explosion Case.

THERE is not a great amount of general interest in the matter of the appeal of the United Alkali Company against the judgment of the Assize Court at Liverpool which condemned them to pay for the injury done to the St. Helens Corporation Gas-Works by the memorable chlorate of potash explosion. Still, there are a few points in the case which will repay notice. The damage was done by an explosion of what was described by the plaintiffs in the action as a highly dangerous, inflammable, and explosive substance. It was left for the Jury to say whether chlorate of potash is of itself a dangerous substance, to which they answered in the negative. They further found that, although defendants did not know that it was explosive when unmixed with other substances, they ought to have known it; that defendants did not take all reasonable care and precautions to prevent accident by fire or explosion; and that such want of care caused, or contributed to, the explosion. On these findings, the Court directed that judgment should be entered for the plaintiffs for an amount of damages to be agreed upon. On the appeal, the defendants pleaded that, so far as their liability for the fire was concerned, the damages resulting to the plaintiffs' property were too remote; and also that they could not be held liable for damages caused by the explosion of a substance which had always been classified by chemists as being non-explosive.

The appeal was dismissed unanimously. The findings of the Jury were curiously expressed; but the Master of the Rolls had no difficulty in interpreting their legal meaning. To say that a substance is not dangerous in itself, means that if left alone it will not "combust." Extraneous matters, in the form of returned empties from a match factory, were brought into the chlorate of potash store, with the result that a fire took place, followed by an explosion which admittedly did the damage complained of. The Jury found that the possibility of such a consequence should have been known to defendants. Now they know it, and must pay for the lesson. This is as much as to say that those who carry on a business must know all the possibilities of it, and cannot plead ignorance of the risk when anything goes wrong. Here was the fact, and it could not be gainsaid. This seems to be the chief lesson of the affair.

The Mines (Eight Hours) Bill in Committee.

IT is not usual for Bills in Parliament to be called into question upon their titles; but such was the case of the Mines (Eight Hours) Bill, which was recently met in Committee with a demand for the postponement of the opening clause. The point taken was a perfectly legitimate one, inasmuch as a title of this kind rigidly defines the scope and character of the Bill. Supposing an "Eight Hours" Bill to be accepted as such, then no amendment in opposition to the principle that the time is to be limited to eight hours could be admitted. The objection was of so novel a character

that the Chairman of Committees of the House of Commons, upon being appealed to for a ruling, could not say whether there was any Standing Order of the House fixing the stage at which the title of a Bill should be considered. As a result, the House found itself discussing the principle of a measure that was not technically before it. The usual kind of desultory talk followed. Members who had promised to support the Federation miners' wishes wanted to vote for the Bill—any Bill with such a name—and be done with it; while others, taking the question more seriously, wished to discuss the merits of the proposal.

When the latter course was adopted, however, it soon appeared that the whole thing was a sham. Representatives of North Country mining districts objected that an Eight Hours Bill for miners looked as if the men affected were expected to work eight hours a day, which they do not, and have no intention of doing. This contention sadly "queered" the petitions of the political agents of the Federation miners, who pretended that their constituents are oppressed and overworked. In the course of the debate, it was admitted that the central principle of the Bill was the statutory limitation of the hours of adult men's labour; the precise figure being immaterial. Knowing this, the Committee proceeded to vote upon the Bill, and carried clause 1, including the title, by a majority of 61. Thereupon "progress was reported." We are indeed a businesslike people!

English Towns in Pawn.

A POPULAR magazine has drawn attention to an aspect of municipal affairs under the current system of financing local government areas, by publishing an article declaring that British towns are in pawn to the extent of 260 millions sterling. This is the amount of money that must be paid before these towns are redeemed. True enough, of course; but the truth is not always presented in this particular light. These cities and borough towns are not exactly bankrupt; but, in order to raise the money for the carrying on of their multitudinous enterprises, they have had to mortgage their assets. In the march towards "progress," our boroughs are fast doing away with private enterprises that formerly ran the tramways, the gas-works, and the water supply, and are carrying these concerns on for themselves as ordinary traders. The profits, if any, are employed usually in the relief of the rates; and where this condition prevails, the ratepayers are jubilant. But the fact remains that the towns do not belong to themselves. They are in pawn; and the vouchers are in the possession of the money lenders who have advanced the cash. This has been going on for 25 years; and, in the broad result, the towns are just able to pay their way and find interest and sinking funds on the borrowed money. There is not ½ per cent. of realizable "profit" after this, which looks as if the grand invention of municipal trading were a failure—as, indeed, persons of a statistical turn say it is. When it is further considered that rates keep mounting up, and that sinking funds do not diminish the gross indebtedness of the municipalities, it is at least possible to think kindly of Ruskin's emphatic protest against the rule of the usurer in municipal matters.

Granting that a large proportion of the local national debt of the country is sunk in what are called reproductive works, it is none the less true that the condition of owning more than one can pay off is not without its drawbacks. All our towns have given some tremendous hostages to fortune. Whether they rest on the prosperity of a particular industry, or on their general prospects, they all owe money that could never be repaid in certain easily conceivable vicissitudes. It is quite a common thing to build a place of worship, or a public hall, on a small gift of land and a big mortgage. If the experiment turns out an initial success, however, those who are responsible for the finances never rest until the debt has been cleared off. It is felt that the property is not safe until it has been paid for. Municipal institutions and enterprises, on the contrary, appear to ignore this principle of financial rectitude. Incurring fresh loans is never objected to on the simple plea that the old ones are hanging over the heads of the people. Yet there is something to be said for this view. Whatever there may be in it, the fact remains that the title of a "Free Town," in the financial sense, cannot be given to a single British borough; and most of them appear to hug their chains.

Report of the Local Taxation Commission.

THE report of the Local Taxation Commission, so far as England and Wales are concerned, was issued as a Blue-book last week. Two interim reports on valuation for local rating have already been published; and others dealing with Scotland and Ireland are yet to come. There is a majority and also a minority report; and some members of the Commission append remarks and observations which almost amount to independent reports. The subjects of urban rating and site values are treated separately. Lastly, one of the Commissioners, Mr. Arthur O'Connor, now a County Court Judge, dissents from his colleagues, and contributes an almost socialistic comment on the whole matter. We have awaited the appearance of this Blue-book with much interested expectation, in the hope that it might contain something to throw a fresh and better light upon the difficult subjects contained in the reference. At present, so voluminous and complicated are the findings and comments of the Commissioners, that we can hardly say off-hand whether they are helpful or the reverse. Much of the Commissioners' time was given to the investigation of the subject of the relations of rate funds and Government contributions in aid. They considered the cry of the occupiers, who urge that they pay too much under the rating system, and the owners too little. Personal property, it is also complained, does not contribute fairly towards local exchequers. The majority of the Commissioners favour an alteration in this respect, and would not be averse to an assignment of a fixed share of the income-tax in aid of local revenues. On the other hand, the separate taxation for local purposes of site values, does not commend itself to the judgment of the Commissioners. The recommendations as to the rating of gas-works, railways, mines, and other special descriptions of hereditaments, are very technical. We cannot go into them here. The rating of machinery is also discussed, and the idea is approved, in respect of fixtures used for the production of motive power, or for lighting and heating the premises.

WATER AFFAIRS.

The Position of the London Water Companies.

THE meeting of the Chelsea Water-Works Company last Thursday completes the record of the progress made in the last financial half year of the five Companies whose proceedings are allowed to be reported in our columns. The Company have done very well; and the Directors had no hesitation in recommending a dividend at the rate of 11 per cent. per annum, inasmuch as it had been more than earned in the six months covered by the accounts. The Company have no less than £52,170 in their reserve and contingency funds; so that the Governor (Mr. F. S. Clayton) was justified in assuring the proprietors that the undertaking over whose destinies he presides is in a strong financial position. The Company a short time ago sustained a great loss by the death of Mr. Richard Hack, their Chief Engineer; but in appointing as his successor a gentleman who had been associated with him—Mr. Albert A. Gill—the Directors have ensured a continuity of his policy in the engineering department. New service reservoirs are in course of construction on Putney Heath; and their completion will form the last link, for the present, in the long chain of improvements which have been effected since this Company, nearly two hundred years ago—to be exact, in 1723—began, under powers granted to them by the first of the Georges, to supply their district with water drawn from the Thames. At first, the crude water was distributed; but in the course of time reservoirs, and eventually filter-beds, were added to the works, and the Company stand out conspicuously as the pioneers of sand filtration. About half-a-century ago, they removed their intake to Surbiton.

As with the Chelsea, so with all the other Companies. Progressive development has been necessary to meet the additional demands made upon them as the result of increased population and changed conditions of town life. This development, as is well known, has of late years been carried out, not with the assistance, but absolutely in face of the antagonism, of a body acting professedly in the interests of the ratepayers, though in reality wasting their money in harassing the responsible managers of a group of undertakings, to the efficient control of which may be attributed in a large measure the general healthfulness of the Metropolis. A water service which furnishes about 35 gallons daily per head of the population cannot truthfully be called inadequate. This was the quantity delivered in London last month; and when the great works at Staines, the progress of

which is recorded in another part of the "JOURNAL," are finished, as they soon will be, a like amount of water will be available daily for an additional million inhabitants—not for a few days or even weeks, but for three months, without replenishing the reservoirs. On the other side of the river, ample storage is being provided; while on the north and east sides of the Metropolis it already exists. With regard to quality, Sir William Crookes and Professor Dewar state in their last report that never within their experience has London water been "in a purer or more satisfactory condition" than it was during the past month. This testimony to its excellence is supported by the Government Analyst (Dr. T. E. Thorpe), who found that, speaking generally, "all the river-derived "waters steadily improved as the month advanced." In no case did he discover an excessive amount of organic matter. These are reports emanating from authorities upon whom, as Sir H. B. Poland was careful to point out at the Chelsea Company's meeting, the public may implicitly rely. The pity is that they will not do so, although they give ready credence to the utterances of blatant orators whose knowledge of the subject is more often than not in inverse ratio to the assurance with which it is paraded.

The London Water Companies have now reached a critical period in their history. The Government are pledged to deal with them on the basis of the recommendations of the last Royal Commission; and in the course of a few months the scope of the Bill which the President of the Local Government Board will introduce in fulfilment of this pledge will be made known. In the meantime, those whose property is at stake are kept in anxious suspense. Transfer will, of course, be provided for; but upon what conditions? We think that arbitration may be confidently looked for; and the Governor of the Chelsea Company ventured to express the hope he and his colleagues on the Board entertained that the clauses in the Government measure would be fairer than those contained in the Bill of the London County Council. Equitable treatment the Companies are fully entitled to—even the authorities at Spring Gardens have come to recognize this—by virtue of the position they occupy as industrial undertakings which initiated and have carried on successfully an enterprise which has been a factor of immeasurable value in improving the hygienic conditions of the Metropolis. In the three centuries which have elapsed since the Dutch engineer obtained permission from the Corporation of London to draw the first gallon of water from the Thames at London Bridge, what advances have been made; for during the past month the river furnished the dwellers upon her banks with nearly 120 million times this quantity every day. To what, it may pertinently be asked at this juncture, are Londoners indebted for the inestimable boon of a good water supply? To that indomitable spirit of enterprise which animated our forefathers, and which, happily for the country, still exists. We must recognize, however, with the potentate of old, that times change, and we change with them. Municipalism is in the air; and there is about the word "municipalization" a certain amount of blessedness for some people which makes it very attractive. If the time has come for the application, in the general welfare of the public, of this principle, or some modification of it, to the undertakings of the London Water Companies, then let it be done; but, in the doing of it, no injustice must be inflicted upon those whose enterprise and skill, exercised over a long course of years, have placed upon their present efficient footing the properties proposed to be acquired. Any such injustice would be un-English; and we firmly refuse to regard this as an attribute of the present Government. We therefore join with Mr. Clayton in the hope he expressed at the meeting of his Company last Thursday.

Wooden Stave Pipe.—One of the features of the water supply systems for water-works, irrigation, water power, &c., in the Western States of America, is the extensive use of wooden pipe, built up of longitudinal staves, and hooped with iron bands. The pipe varies from 3 inches to 10 feet in diameter. At Toronto, a 4-feet wooden stave pipe has been in service for the water-works since 1851, and is still in good condition. The pipe may be banded by separate hoops, usually of round iron bars, and may be spirally wound with a heavy iron rod; the pitch of the spiral varying from $4\frac{1}{2}$ inches for 20 feet head, to $2\frac{1}{2}$ inches for 150 feet head. Pipe fittings, such as elbows, tees, crosses, &c., are of cast iron, with sockets for the wooden mains. Screw fittings and gate-valves are used for hydrants, blow-offs, &c. The San Diego Flume Company alone are said to have 35,000 feet of this pipe, from 6 to 36 inches in diameter, in use.

INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SEVENTH ANNUAL GENERAL MEETING,

HELD AT THE

ROYAL UNITED SERVICE INSTITUTION,

JUNE 11TH TO 13TH, 1901.

Mr. T. ORMISTON PATERSON, M.Inst.C.E., President.

PAPERS READ.

HIGH AND LOW PRESSURE GAS INCANDESCENT LIGHTING.

By WILLIAM SUGG, of London.

The Lord Mayor of London, in his speech at the Common Council in the early part of this year, complained of the "unsatisfactory manner in which the streets of the City are lighted." Money has been spent in the most liberal manner in putting up immensely tall lamp-posts of various artistic designs, surmounted by a cast-iron arrangement resembling the old signposts seen outside inns in some parts of the country. From this, instead of the sign, hangs an electric globe arc lamp, which generally, when it is lighted, has a smudgy-looking shadow at the top and bottom of the globe. For one-tenth of the money which has been expended over this unsatisfactory lighting, it is safe to say that a magnificent and much more practical result could have been obtained if gas had been used.

Mr. Corbet Woodall, in his presidential address to the Southern Association of Gas Engineers and Managers, delivered on March 14 last, said: "I know many cities, in many lands; and I am constrained to declare that London, which saw the first Gas Company started nearly a hundred years ago, is at this hour the worst lit capital city in Europe. To return to London from Vienna, Berlin, Paris, or Brussels, is to pass from light and cheerfulness to dismal darkness and gloom. Yet gas is far cheaper in London than it is in any other capital; and its quality is higher. This condition of things as regards the public lighting of London is a scandal, a reproach, and a danger. It is not that those who should take pride in having the best of everything for our wonderful Metropolis can plead ignorance of the possibilities of gas lighting. Here and there—in spots—the gas lighting is splendid, the very best in all the world."

Mr. Woodall referred to the lighting of a part of the Strand by means of the new high-pressure incandescent gas-lamps of 1000-candle power each, which are fixed at the crossway formed by Wellington Street, Waterloo Bridge, and the Strand. Although there are several electric lights in close proximity to the 1000-candle gas-lamps at Wellington Street, they, as *Mr. Punch* says, "blink in dismay." There are six of these powerful lamps at this point, each furnished with a cluster of three high-pressure incandescent burners consuming an aggregate quantity of 30 cubic feet of gas per hour. Each burner is provided with a special Welsbach mantle made for use with high-pressure gas, and of the model originally designed by the writer, and made and supplied to him by the Sunlight Incandescent Mantle Company previous to their amalgamation with the Welsbach Company.

A large number of experiments made by the writer proved that the mantles manufactured after this model gave a much better result in illuminating power, and lasted longer, than the No. 4 Welsbach mantles which he first used with high-pressure burners. The duration of these mantles has been found to average in all the installations which he has carried out in various parts of the kingdom, one to two months, and sometimes even as much as four months. Their shorter average life is, of course, due very much to the number of mantles which break up at once on being lighted, because of some broken threads or other defects in the manufacture, and also sometimes by carelessness on the part of the lamplighter. But with properly-made mantles, burning in suitably ventilated lanterns, and with ordinary care, they ought to last on the average from

six weeks to two months. The stronger mantles now made are much superior in light-giving power and durability to those which were supplied at the inception of his system of lighting.

In localities where there is such a great vibration as there is in the Strand and Whitehall, each burner should be furnished with an anti-vibrator, in order to preserve the mantle from the continual slight shocks caused by passing vehicles; and this has been provided against by means of special springs. The importance of using a lasting mantle, notwithstanding its greater cost, is obvious.

I dare to say that the electric arc light is not suitable for street lighting for many reasons—the principal ones being its want of volume, and the apparent solidity of its shadows. It is a significant fact that on the Continent, in Germany and France, incandescent gas lighting is taking the place of electricity, because it is much steadier and has greater volume.

In a paper read before the Gas Institute, many years ago, the writer pointed out the difference between the volume and intensity of light, by the effect produced in lighting a coal wharf by means of the old-fashioned brazier filled with burning coal. This threw a great volume of light of a reddish colour all round with practically no shadow; while the rays of an arc lamp of the same power were so intense, and the shadows appeared so solid, that the men mistook them for planks, and accidents happened in consequence. The reason of this is that the arc electric light has so much blue and violet rays in it as to affect most injuriously the eyesight, and at the same time reduce the volume of useful rays. In fact, the light from the coal brazier, consisting principally of the red and yellow rays, is diffusive, somewhat like the light of the sun, while the rays of the electric light, of high refrangibility, emanate from a very small point no bigger than the top of the finger, and therefore the shadows are hard and black. For example: The area of illumination of a brazier, when thoroughly incandescent and giving a light of about 1000 candles, is from 150 to 160 square inches, while that of an electric arc light of the same candle power is not more than $\frac{1}{2}$ square inch. Hence the troublesome shadows.

The question of the rapid advance of gas in lighting streets, large spaces, railway stations, docks, &c., depends much on the possibility of being able to get good mantles as well as good burners. On this latter point, it is to be noted that, exactly as with the old standard London argand burners, in order to obtain the highest duty per cubic foot of gas consumed, the pressure at the point of ignition must be very low; and as Sir Frederick Bramwell said, in speaking in Court in the celebrated Silber trial, "the flame must be kept hot."

The velocity of the issuing gas, when lighted, through the 24 holes of the London standard argand burner is 5·25 feet per second, when it is consuming 5 cubic feet of gas per hour; and the pressure at the point of ignition is about $\frac{1}{100}$ of an inch. The duty obtained with 16-candle gas for this consumption is 3·2 candles per cubic foot. The number of holes in the inner ring of the writer's low-pressure 110-candle incandescent burner, which consumes also 5 cubic feet of gas, is 12, and that of the outer ring is 24. The aggregate area of the 36 holes is 113 square m.m. The quantity of gas which passes through the jet at the base of the burner—viz., 5 cubic feet per hour—issues at a velocity of nearly 111 linear feet per second.

The air for the combustion of this quantity of gas inside the mantle induced by the velocity of the jet of gas, is about 5 feet of air to 1 foot of gas. Assuming these proportions to be correct, then the velocity of the gas at the point of ignition would be about 30 per cent. greater than it is in the London argand burner. The illuminating power of 5 feet of gas thus consumed by the low-pressure incandescent burners is from 110 to 120 candles, according to the quality of the mantle, or from 22 to 24 candles per foot, as compared with a total of only 16 candles produced by the London standard argand burner for the same quantity of gas, or 3·2 candles per cubic foot.

With the writer's high-pressure burner used at Wellington Street and other places in clusters of three, forming the 1000-candle lamps, the volume of gas issuing from the jet is about 10 cubic feet per hour; and its velocity is about 260 linear feet per second. The volume of air passing up the tube of the burner induced by this 10-feet jet of gas is estimated to be 70 cubic feet per hour to 10 cubic feet of gas; and the velocity of the issue of the mixed gas and air at the point of ignition would be about 12·5 linear feet per second, or nearly double that of the low-pressure incandescent burner. The result obtained for this consumption is 320 candles, with a good mantle—32 candles per foot.

It is remarkable the standard London argand gives 3·2 candles only per cubic foot of gas consumed, or one-tenth the amount of light which the gas can yield, when burnt in a high-pressure burner. The quantity of air supplied into the interior of the mantle with the gas is not sufficient to produce perfect combustion; but the mixed gas and air burning under the mantle exercises a very powerful attraction on the oxygen of the surrounding atmosphere, and causes it to part company with the nitrogen, with which it is only mechanically combined, and diffusing itself through the meshes of the mantle, meets the heated mixed gas, and combining with it on the surface of the mantle produces a very brilliant white light, very similar to the oxy-hydrogen lime light. This duty of 32 candles to the foot does not seem to be increased per cubic foot by an increase in the velocity of the volume of gas issuing from the point of ignition of the burner; but the illuminating power of the burner can be increased up to about 400 candles, with an increase of 2·5 cubic feet of gas, or a total consumption of 12·5 feet instead of 10 feet. This extra 2½ feet of gas gives to the burner a considerable increase of light, and the extra 2½ feet represent a duty of 40 candles to the foot including the 32 candles mentioned. This quantity of gas—viz., 12·5 cubic feet per hour—issues at a velocity of about 300 linear feet per second from the jet at the base of the burner, and 18 feet per second from the point of ignition.

The writer's London argand burner, K size, consuming 10 feet per hour, has a ring drilled with 42 holes and a central jet. The pressure at the point of ignition is rather less than that of the London standard argand. The velocity of the issuing gas at the point of ignition is 3·8 linear feet per second, instead of 5 feet per second as with the London standard argand. The illuminating power obtained for this consumption is 45 candles, or 4·5 candles to the foot. The velocity at the point of ignition in the argand, and in the incandescent burners, is as follows:—

Standard London argand	5·25 ft. per sec.
New 5-feet low-pressure incandescent . .	6·80 ,, ,,
K argand, burning 10-feet per hour . . .	3·80 ,, ,,
10-feet high-pressure incandescent . . .	12·60 ,, ,,
12-15 feet high-pressure incandescent . .	18·00 ,, ,,

It is apparent from these figures, that with incandescent burners, the velocity with which the gas issues from the jet at the base of the burner is a very important factor in obtaining these high results. It is also clear that a much increased velocity of the gas issuing from the top of the burner is of no less importance, but this velocity must be without appreciable pressure.

Referring back to what was known about incandescent and other burners at the time of the Electric and Gas Exhibition, 1882-83, as to the conditions under which an improvement in the illuminating power of the gas was to be obtained, it is noticeable that these two important conditions did not appear to have been known to the inventors of the early incandescent burners which were then shown there by Lewis, Clamond, and Popp. They, with their gas and air under high pressure—from 6 inches, and even as high as 14 inches—did not obtain more than about 4·26 candles to the foot, which was less than that obtained by Siemens's 266-candle recuperative lamp, with a consumption of 55·75 feet, or 4·77 candles to the foot, and the author's 451-candle argand, with a consumption of 94·80 feet per hour, or 4·77 candles to the foot. The writer's flat-flame Lambeth lamp, with 28·30 feet per hour consumption, also gave 98 candles, or 3·76 candles to the foot; so that at that time, notwithstanding all that had been done, there was comparatively very little improvement on the London argand standard burner.

Both the Lewis and the Popp burners were fitted with mantles made of fine gauze platinum; and it is rather curious that in this respect the originator of that idea was the late celebrated French chemist, St. Claire Deville. The writer, in the year 1865, was told by this distinguished *savant*, in a lecture he was giving to students, that "we did not burn gas properly so as to get the best result from it." He said: "You use a Bengel burner (argand) like this [and he lighted up the burner]. Now you do not get anything like the volume of light you ought to be able to get from this quantity of gas (about 5 feet). But if you take off the chimney and put this little *manchon* on the combustion chamber, you will see a very different result." The little

manchon was a mantle made of very fine platinum gauze. He then replaced the chimney and lighted the burner. The result was indeed very different, and greatly astonished us. He, however, turned it out very quickly, saying that "he could not keep it alight any longer for fear of destroying the *manchon;* but," said he, "this is the way in which you must march." This was, I believe, the first idea given to the world of the method of incandescent lighting by gas, and what it could accomplish.

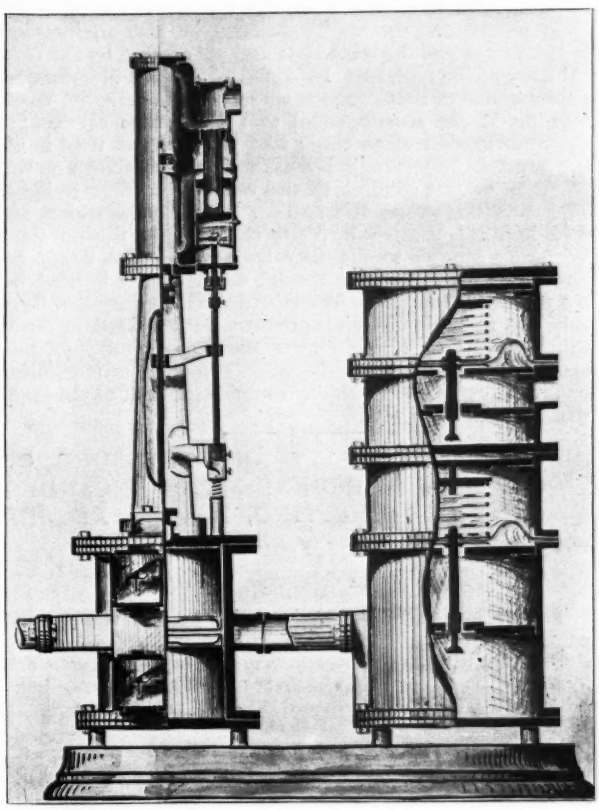
Just before the Electric and Gas Exhibition at the Crystal Palace above mentioned, M. Clamond, of Paris, produced a burner fitted with a *manchon* made of oxide of magnesia, which looked very much like a long strawberry basket. As I have said, with a consumption of 7½ cubic feet of gas per hour, he only obtained a light equal to 32·7 candles. With the new burners of to-day, we should get easily more than 150 candles for that consumption. He used a long chimney.

There was no further advance made in obtaining a higher illuminating power per cubic foot of gas than this until the Health Exhibition in London, when a Wenham lamp (an improvement on Grimstone's inverted burner shown at the Crystal Palace Electric and Gas Exhibition) and a "Cromarty" lamp by the son of the writer, gave an illuminating power of about 8 candles to the foot. Both these burners, with subsequent improvements, reach at the present day to the figure of 12 candles to the foot, with a consumption of 15 or 20 feet per hour.

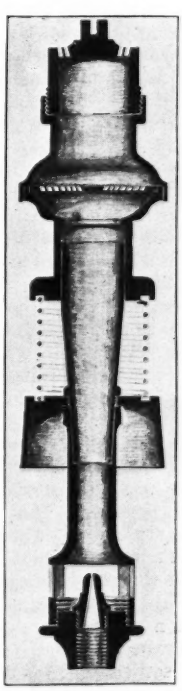
The very high result which can be obtained from gas at the present moment is principally due to the discoveries of Baron von Welsbach, who appears to have been the first to find that the platinum gauzes were useless for the manufacture of mantles for incandescent gas, and that what was required was a mantle made of materials which were able to support, without melting away, the intense heat produced by the combination of the oxygen and the mixed gases on its surface. The peculiar property of platinum of becoming incandescent when exposed to a current of gas, misled all who, like the writer, had been making experiments from time to time with it during all the years which elapsed from the time St. Claire Deville showed his mantle and the discovery of Welsbach.

This paper has been prepared with the object of placing before the members, as briefly as possible, some of the principal points in the improvements which have been made in the illuminating power of ordinary gas during the last thirty years. It may seem to some that the progress has been slow, and that the improvements have been rather spasmodic than otherwise. The remark of the great *savant* St. Claire Deville, that we should march in the way of incandescence if we desired to effect improvements in producing light by the use of gas, slumbered for many years before the first Welsbach mantle was exhibited in Vienna. From that time, it has steadily progressed until we have arrived at a new era in gas lighting. The new century will certainly see gas taking an important position in public and private lighting, owing to the marvellous developments which have taken place in the facilities for its application, and to its steadiness and cheapness. Already, proprietors of railways, docks, and large workshops have adopted it; some of them abandoning the electric arc lamps, which are uncertain in their action, and sometimes suddenly go out or drop to a very low light. Where machinery is in motion, this is extremely inconvenient, and even dangerous. The writer does not anticipate that there will be any further reduction of the quantity of gas consumed to an almost vanishing point concurrently with an increase in the illuminating power per cubic foot, as some seem to expect, but rather believes that an enormously increased light will be produced, with present consumptions of 4 and 5 cubic feet per hour in the smaller lamps and private lights, and a much greater increase in larger consumptions of 30 and 50 feet for important street lighting, railway and dock lighting, &c. He considers that the general public and local authorities desire to get a much whiter light, more approaching to daylight, of very much greater volume, which will not injure sight, and that they do not so much wish for a reduction in the quantity of gas they have been accustomed to burn to produce the insufficient light which they now generally obtain with the use of the old-fashioned burners. From about 1 candle per cubic foot of gas consumed with the old fishtails and batswings, to 32 candles per cubic foot now obtainable by incandescent burners and mantles, is nothing less than a marvellous progress.

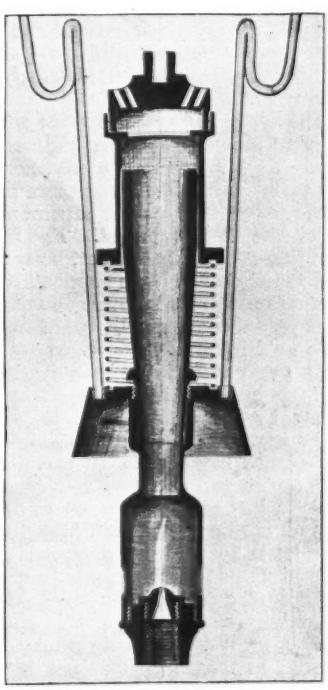
In conclusion, it should be observed that, for the purpose of facilitating the comparison of the results obtained by the different burners mentioned—viz., the London argand, the incandescent high and low pressure burners, and those of Lewis, Clamond, and Popp, and the combination flat-flame burners—all are given as they appeared when tried on a long bar photometer; the volume of light yielded by horizontal rays only having been measured. The Wenham and the "Cromarty" were measured at an angle of 45°. But the full duty to be obtained by the use



Sugg's High-Pressure Apparatus.



Sugg's High-Pressure Burner.



Sugg's Low-Pressure Burner.

of the incandescent high and low pressure burners would be, in such a lamp as is shown on the diagram, fully 30 per cent. more than that obtained in the photometer-room on the bar photometer, because, first, of the large reflecting top of the lantern and the increase in illuminating power due to the supply of air to the burner being warmed, instead of being cold, as it was when the burner was used in the open photometer-room. There must be also an increase in the velocity of the mixed gas and air created by the long chimney of the lantern. In consequence, the illuminating power of one of these 1000-candle lamps is actually, when burning in the streets, equal to 1200 to 1250 candles for the consumption of 30 cubic feet per hour, as used in all the nominal 1000-candle lamps, such as are shown on the diagram, or 41·3 candles to the cubic foot effective light. The diagram shows the pattern of the lamps which are now lighting Whitehall, Victoria, and the Strand from Waterloo Bridge to the City boundary. The lamps on Southwark Bridge, of a special construction, lighted by the writer for the South Metropolitan Gas Company, have only one 10 cubic feet high-pressure burner fixed in each, which gives a very high duty of about 400 candles for this consumption, because of the large reflecting surface, filled in with silvered glass, which occupies the half of the lamp which faces the river.

EFFECT OF QUALITY AND PRESSURE OF GAS ON THE EFFICIENCY OF INCANDESCENT GAS LIGHTING, HAVING REGARD TO ECONOMY.

By WALTER GRAFTON, of Beckton.

The first thought on reading the title of the present paper, may be that there is very little more to learn relating to the kind of gas, and particularly to the pressure at which it is supplied, to incandescent burners. It will, however, be found, after careful consideration, that many problems have to be solved before an advance can be made on the results so far achieved.

The paper really originated in the simple operation of changing a consumer's meter; the author noting at the time a certain observation in connection therewith. From this, it may be gathered that air is one factor, and poor-quality gas—the outcome of the addition of that air—another. Yet a third, is the pressure of the gas supply. Reliable experimental figures will be given to show that at least some of us have a little to learn in the supply of cheap illuminating gas; and it is hoped they may stimulate the progress of the gas industry.

The system of distribution of illuminating gas is a matter of great moment to every right-thinking gas manager to-day. This is especially so when we consider that, by whatever method adopted, there are conditions prevailing either advantageous or detrimental to the purpose for which the gas is supplied. The flat-flame burner requires far more delicate treatment, both in regard to the quality and pressure of the gas supplied to it, than does either the incandescent bunsen burner or the gas-stove; yet all must be supplied economically if our industry is to progress, or even hold its own.

As two papers have been read at this meeting relating to high pressure incandescent lighting, only a few comments by the author need be made upon it. Opinions differ as to what constitutes high and low pressure; but the author looks upon all pressures of supply of 4 inches and under to constitute low pressure, and any pressure above 4 inches head of water to be high pressure. But, of course, although this limit is defined as regards high pressure, it is not to be understood that 12 inches would be very high. It is a mere matter of convenience; only that, for ordinary lighting purposes, gas is not, as a rule, sent away from a distributing gas-works at a pressure greater than 4 inches. For this reason, experiments have been limited to that pressure—not because of the old idea of increased leakage with augmented pressure, but that a moderate pressure alike for most industrial purposes, as well as for pleasing the public, will always be found the most economical.

Where increased pressures are desired, there are several systems, more or less non-mechanical and free from expensive plant, to be obtained. The simplest way, however, is to increase the pressure at the outlet of the works. The carrying capacity of the mains has to be considered; and in this respect the author fails to see any great difference between a main carrying gas under 15 inches pressure for supplying low-pressure burners, and one carrying a volume of gas under 3 inches to feed intensifiers which augment the pressure to 15 inches at the burners. Of the two methods, it is believed that the former will yield the most economical and satisfactory service to the public. With incandescent lighting, far more mantles are wasted or destroyed by this local high pressure, than by a universal reduced-pressure system in the craze for more light. The days of extremely low pressures are at an end; and yearly the average supply of gas is being sent out under a greater pressure, until 3 or 4 inches will be the ruling minimum figure, instead of 5-10ths to 7-10ths.

In order to ensure increased popularity for the incandescent system of gas lighting, we must acquaint ourselves with all that affects its efficiency. Naturally, we are led to think that the quality of the gas supplied to the bunsen burner is the chief factor in augmenting or diminishing the economical effect, since the perfect combustion of a particular grade of gas depends upon the quantity of air drawn in the bunsen tube or mixer. The quality really has very little to do with it, providing that a proper quantity of air is supplied to bring about a unit mixture of gas and air before reaching the point of combustion. As a matter of common knowledge, the Welsbach "C" burner is regulated to consume $3\frac{1}{2}$ cubic feet of 16-candle gas; and when this quantity is departed from, either more or less, or the quality of the gas is better, the efficiency of the burner falls.

The quality of the gas supplied, however, is not the only factor at work. We have the nature or kind of gas used, apart altogether from its illuminating power; and the pressure of the particular gas supplied may have to be a little more or less than 1 inch. All three conditions have a separate bearing, independent of the length of the chimney used, in bringing about that efficiency. If the chimney be a 7-inch one, then the illuminating power of the gas—whether consisting solely of coal gas or a mixture of carburetted water gas and coal gas—and the pressure unite in influencing the amount of light emitted by the mantle. The atmospheric air is another factor at work, more or less not made use of, which after all has by far the greatest influence upon whatever result is obtained.

We have all seen some installation of intensified gas lighting, and have been impressed with the effect produced; but have we considered the cost? When taking out the cost of these systems, it is not enough to reckon simply the quantity of gas consumed; the plant and upkeep, including mantles, must, of course, be included. With the high-pressure system, the life of the mantle is very short as compared with the low pressure. Does the extra lighting effect fully repay all the trouble and extra cost of maintaining the mantles? The author thinks not; for it is extremely difficult, if not impossible, to get reliable figures as to the number of renewals per burner per annum.

The high-pressure is superior to the present low-pressure system, because, with the latter, the gas issues at too feeble a pressure to induct the proper volume of air at the bunsen tube to ensure rapid combustion, and so protracted combustion follows. It is not to be understood that unburnt gases pass away; but those products have not been burnt quickly enough in order to get the greatest heat in the vicinity of the mantle-fabric to be heated to incandescence. Most of the air in this case is inducted by the chimney outside the mantle, and so perfect combustion of the gas takes places away from the mantle, resulting in a low illumination per cubic foot of gas consumed.

By adopting the high-pressure system, the gas-orifices in the burner must be reduced in number and size to restrict the flow of gas. Then, in order to obtain the same volume of gas passing as by the low-pressure system, the pressure has to be augmented; and with this increase of pressure, a greater suction is brought about at the jet. Consequently a greater volume of air is drawn in, independent of the chimney, which, if used, really inducts less air than before. This brings about rapid combustion, and at the right point; and so produces more heat and light per unit of gas.

One of the factors determining the temperature of the air-gas flame is the degree of intermixture of the combustible gas and air; and many attempts have been made, particularly in incandescent gas lighting, to render the intermixture as perfect as possible. By the author's

TABLE I.—*Showing the Effect of Supplying Incandescent Burners with Different Qualities of Gas. Standard of Comparison 10-Candle Pentane.*

Series.	Description of Gas Used.	Illuminating Power by Argand. 16-Candle Basis.	Type of Incandescent Burner and Mantle Used.	Pressure of Gas Supplied to Incandescent Burners, Light Emitted, and Gas Consumed.											
				1 in.		1½ in.		2 in.		2½ in.		3 in.		3½ in.		4 in.	
				Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.	Light in Cndls.	Rate. Cubic Feet.
A.	Poor coal. . .	13·32	"C" and "C" mantle	56·0	3·77	58·0	4·56	60·0	5·45	56·0	6·20	56·0	6·74				
	ditto + air . .	*10·98*	"	*52·0*	*3·50*	*76·0*	*4·41*	*81·5*	*4·90*	*86·5*	*5·55*	*93·0*	*5·99*				
B.	Stripped mixed	14·18	"	57·0	3·51	56·0	4·36	55·5	4·76	55·5	5·40	55·5	5·80	55·5	6·19		
	ditto + air . .	*9·90*	"	*59·5*	*3·17*	*68·0*	*3·96*	*74·0*	*4·36*	*80·5*	*4·93*	*86·0*	*5·35*	*92·5*	*5·74*		
C.	Stripped mixed.	14·80	"	57·5	3·40	53·0	4·40	53·0	4·82	49·0	5·40	49·0	5·95	48·0	6·30		
D.	Coal	15·65	"	63·0	3·54	76·0	4·18	77·0	4·82	76·0	5·70	72·5	6·04	69·0	6·53	65·0	7·03
	ditto + air . .	*12·92*	"	..	..	*45·0*	*2·90*	*66·0*	*3·44*	*86·0*	*4·08*	*95·0*	*4·47*	*108·0*	*4·92*	*116·0*	*5·36*
	Coal	15·65	No. 3 Kern and mantle	50·0	3 00	75·5	3·88	80·0	4·33	82·5	5·02	82·5	5·46	88·0	5·85	97·0	6·29
	ditto + air . .	*12·92*	"	..	..	..	..	*51·0*	*3·00*	*72·0*	*3·58*	*88·0*	*3·93*	*91·5*	*4·38*	*112·0*	*4·82*
E.	Mixed. . . .	16·19	"C"	51·0	3 40	56·0	4·10	57·5	4·82	62·0	5·25	61·0	5·65	52·5	6·25		
	ditto + air . .	*12·93*	"	*38·5*	*2·00*	*56·0*	*2·69*	*71·0*	*2 90*	*78·0*	*3·30*	*87·5*	*3·65*	*94·0*	*4 20*		
F.	Mixed. . .	16·48	"	55·0	3·13	62·0	3·89	61·5	4·65	61·5	5·26	61·5	5·71	60·0	6·01		
	ditto + air . .	*14·68*	"	*38·5*	*2·27*	*56·0*	*2·68*	*76·5*	*3·23*	*89·0*	*3·84*	*92·0*	*4·30*	*93·0*	*4·70*		
G.	Mixed. . . .	17·35	"	63·0	3·33	75·0	4·25	70·5	4 69	69·0	5·22	67·0	5·70	63·0	6·28	59·0	6·66
	ditto + air . .	*15·69*	"	..	..	*42·0*	*2·66*	*74·0*	*3·23*	*90 0*	*3·92*	*105·0*	*4·35*	*115·0*	*4·73*	*126·0*	*5·12*
	Mixed. . . .	17·35	Kern	60·0	2·93	78 0	3·61	80·0	4·29	74·0	4·82	76·5	5·12	85·5	5·83	90·0	6·17
	ditto + air . .	*15·69*	"	..	..	*40·5*	*2·36*	*65·5*	*2·80*	*80·5*	*3·32*	*88·0*	*3·61*	*111·0*	*4·09*	*127·0*	*4·53*
	Mixed. . . .	17·36	"C"	..	..	..	..	..	..	..	..	..	..	62·0	5·90		
	ditto + air . .	*14·88*	"	*48·0*	*2·27*	*63·0*	*2·74*	*75·0*	*3·50*	*89·0*	*3·72*	*94·5*	*4·00*	*105·0*	*4·66*		
H	Mixed. . . .	17·36	Kern, with "C" mantle.	64·5	3·03	76·5	3·75	85·0	4·55	92·0	5·00	94·0	5·35	99·0	5·65	106·5	6·15
	ditto + air . .	*14·88*	"	..	..	..	..	*39·0*	*2·85*	*63·0*	*3·37*	*78·0*	*3·75*	*125·0*	*4·05*	*161·0*	*4·65*
	ditto and air adjuster used. .	"	"	..	..	*55·0*	*2·60*	*76·5*	*2·85*	*90·0*	*3·37*	*98·0*	*3·75*	*125·0*	*4·05*	*161·0*	*4·65*
I.	Rich mixed . .	18·30	"C"	55·5	3·41	50·0	4·21	47·5	4·72	46·0	5·30	44·5	5·70	42·0	6·32		
J.	Carb. water . .	19·90 Cannel burner	"	53·0	2 77	72·0	3·50	86·0	3·94	88·0	4·48	92·5	4·87				
K.	Carb. water . .	23·70	"	62·0	2·85	80·0	3·57	87·0	4·00	88·5	4·50	89·0	4·80	93·5	5·30		
L.	Water. . . .	..	"	none	2·80	none	3·45	none	4·10	18·0	4·60	24·0	4·95	32·0	5·30	42·0	5·75
	ditto. . . .	..	Kern	none	2·65	8·00	3·20	21·0	3·60	27·5	4·20	32·5	4·60	36·0	4·90	40·0	5·25

TABLE II.—*Detailed Figures of Series E and F.*

Series E.	Argand (16 c. basis).	"C" Burner 1 in.	1½ in.	2 in.	2½ in.	3 in.	3½ in.	Average 2½ in.
Gas consumed . . . . . cubic feet	6·2	2·0	2·6	2·90	3·30	3·65	4·20	3·11
Air passed in . . . . . " "	1·62	1·0	1·1	1·18	1·32	1·33	1·33	1·21
Percentage of air added	26·1	50·0	41·5	40·70	40·00	36·20	31·60	40·00
" " gas consumed	125·0	60·0	63·1	60·00	62·80	64·60	67·20	62·95
" " reduction of gas	—	40·0	36·9	40·00	37·20	35·40	32·80	37·05
Light in candles per 3½ cubic feet of pure gas .	—	52·7	48·0	41·70	41·30	37·70	29·40	41·80
" " " " of gas + air .	—	67·4	75·4	86·60	82·50	83·60	78·20	78·95
Gain in light in candles by adding air per 3½ c. ft	—	14·7	27·4	44·90	41·20	45·90	48 80	37·15
Series F.								
Gas consumed . . . . . cubic feet	5·400	2·27	2·680	3·24	3·84	4·30	4·70	3·50
Air passed in . . . . . " "	0·875	0·85	0·875	0·90	0·90	0·92	0·92	0 894
Percentage of air added	16·200	36·40	32·100	27·30	23·00	21·10	19·80	26·61
" " gas consumed	112 500	72·60	68·800	70·00	73·00	75·20	78·10	72·95
" " reduction of gas	—	27·40	31·200	30·00	27·00	24·80	21·90	27·05
Light in candles per 3½ cubic feet of pure gas .	—	61·40	55·700	46·00	41·00	37·50	34·90	46·10
" " " " of gas + air .	—	59·00	73·400	82·70	81·10	74·00	69·20	73·23
Gain in light in candles by adding air per 3½ c. ft.	—	—	17·700	36·70	40·10	36·50	24·30	27·13

TABLE III.—*Average Percentage of Air Mixed with Gas.*

Series A. ..	not known ..	in holder ..	"C" burner	Series F. ..	26·6 .. after gas-meter .. "C" burner
" B. ..	25·0 ..	" ..	"	" G. ..	21·8 .. " .. "
" D. ..	20·0 ..	after gas-meter ..	"	" G. ..	24·9 .. " .. Kern burner
" D. ..	24·4 ..	" ..	Kern burner	" H. ..	27·1 .. " .. "C" "
" E. ..	40·0 ..	" ..	"C" "	" H. ..	26·2 .. " .. Kern "

method, instead of mixing air with the combustible gas after the gas has been supplied to the burner, he adds air to the gas before it arrives at the burner. This may be done either at the gas-works (before or after storage, but before distribution) or in the service main or pipe at or near the place of consumption.

It would not be advisable, except in particular cases, with special precautions, to add to the gas all the air necessary for complete combustion before it is supplied to the burner, lest an explosive mixture be formed in the service main or pipe. The author prefers, therefore, to use air-gas burners of the ordinary type, and to add only a portion of the air necessary for complete combustion before the gas is supplied to the burner—leaving the burner itself to suck in the rest through the ordinary intakes, which may have to be regulated in size by any well-known device, according to the proportion of air required above that already supplied.

This method is particularly applicable for incandescent gas lighting; and the author finds that, with ordinary burners—such as the Welsbach "C" or the Kern burner—he obtains greatly increased candle power with a diminished consumption of combustible gas, by adding to the gas, before it is supplied to the burner, air to the extent of from 5 to 30 per cent. of the volume of the gas. These figures, however, are given merely as indicating the amount which will produce a beneficial result; for the candle power or calorific value of the gas and the pressure at which the gas is supplied are variable factors in influencing the amount.

One of the author's plans is to put into the service-pipe on the consumer's side of the meter a T-piece, one branch of which is connected with a gasholder containing air under pressure slightly greater than that in the service-pipe. From this holder, air is admitted into the pipe at a rate regulated by a stopcock according to the quality of the gas supplied and the amount of reduction thought necessary. Any pump may be substituted for the gasholder. Low-quality gas made in this way is more effective than by any other known process of manufacture. The carbonization of coal can be pushed to the utmost limit, so getting all available gas, and then air may be added to advantage, as will be seen upon reference to Table I. Series A, a poor-quality coal gas, gives a far better result than a rich gas like series I; but this is not all. There is actually a two-fold saving in gas, since the quantity of poor gas consumed is about the same as with rich gas and costs less per 1000 cubic feet.

The results by the "C" burner, using a 7-inch chimney

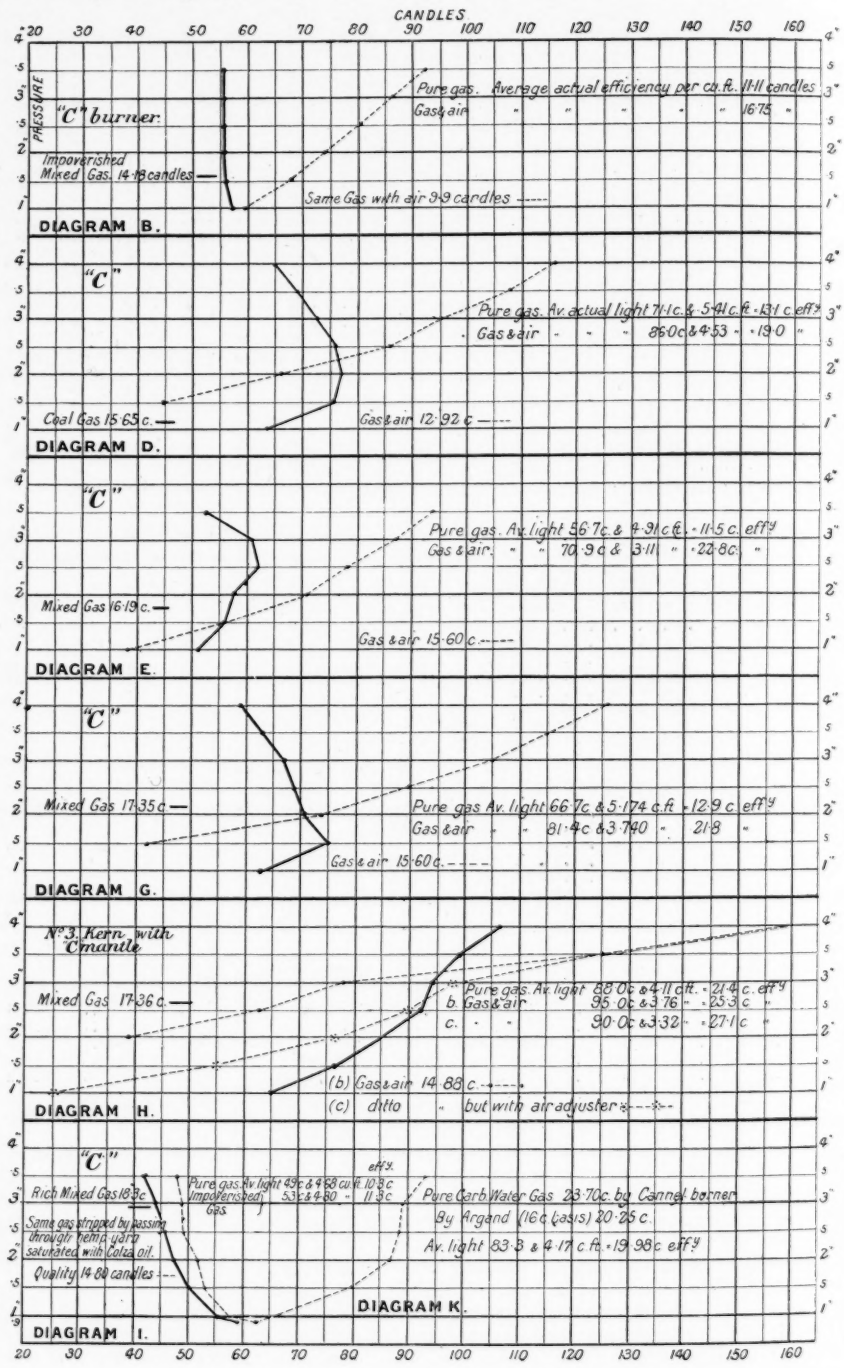
and pure gas, decrease with an increase of pressure; whereas, by using the same gas after adding air to it, or allowing air to flow in and mix with it on its way to the burner, the illuminating power increases to an extent that it remains constant per unit of gas consumed. This is a very important matter; for it proves that the sooner the standard of quality is reduced, the better for the public and the gas companies. The author would not recommend reducing the quality below 10 candles; for the reason that a small self-luminous flame is of great service in many ways and places. Photometry may still rule over this grade of gas; but when one considers that the mantle is almost becoming cheaper daily, the need to test such gas would be superfluous. Low-grade gas, consisting of a mixture of gas and air, could easily be distributed, and with far less danger than a rich gas; for its specific gravity is higher, and consequently less of such gas would escape through any orifice than pure gas. It means a little more pressure; but the ordinary service pressure is now becoming greater. It does not mean larger mains—in fact, to-day many of you are sending away 17-candle gas under as great pressure as would be required to distribute low-grade gas; and the former not giving one-quarter the satisfaction as would this low-grade cheap gas of the future.

The mantle is as a glowworm when heated with this low-grade gas to that of a mantle heated with 17-candle gas. The low-grade gas secures a uniformly incandescent mantle from base to apex; and the burners do not emit so much of that unpleasant hissing noise so noticeable when the pressure is greater than 3 inches. In fact, you have the same efficiency as if by intensified systems, and at the same time far less wear and tear on the mantle; consequently a longer life. As an instance, the author, using a No. 1 mantle, has obtained an easy 132 candles on a special burner supplied with 16-candle gas under 9 inches head of water. The consumption was exactly 3½ cubic feet, so the efficiency is 37·7 candles per foot consumed. But the life of the mantle was only two days—it was really blown to pieces. While with 1½ inches pressure and burning 14-candle gas, a "C" mantle has been in use over two years.

Stripped gas in the table signifies that a richer gas was reduced by passing it through a scrubber of colza or boiled-linseed oil. All other gases are produced by the usual processes of manufacture. Each series was made with gas collected in a 15-cubic feet holder and passed through an experimental meter on the photometer. The quantity of air used to impoverish the gas was, with the exception of Series A and B, measured by a second experimental meter and passed into the service before the regulating tap, but after the gas-meter. In this way, the quantity of both gas and air was accurately determined. The average percentage of air used in each series is given in Table III. Table II. gives the complete detailed figures of Series E and F. In the last column will be found the mean result; the pressure working out to 2¼ inches. There is a gain of 37 candles per 3½ cubic feet, or nearly 10½ candles per foot of gas consumed, by adding some air to the gas before the burner is reached in the one case, and 27 candles in the other.

The experiments show that for every 1 per cent. of air added an increase of 1 candle is obtained from the mantle per 3½ cubic feet, or about 0·3 candle for every cubic foot of gas burned. All the gas used was tested in the argand burner by producing a 16-candle flame, then correcting to 5 cubic feet, except the carburetted water gas, which was tested at the 5 cubic feet rate. All the consumptions are corrected to N.T.P. Burning the gas at the rate of 5 cubic feet gave, in one case, 16 candles; but by adding 25 per cent. of air, and testing the quality of the mixture, it was only 5·1 candles, whereas, on the 16-candle basis, 11·24 candles was obtained, or just double. Using Bray's No. 5 special union-jet burner, it consumed 4·45 cubic feet of the same mixture, and only gave a light of 1 candle. Much might be said about poor gas and flat-flame burners; but this would be departing from the subject. One per cent. of air reduces the illuminating power of 16-candle gas nearly 2·8 per cent. on the 16-candle basis.

Experiments B, D, E, G, H, I, and K (Table I.) are plotted


CANDLES
20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
PRESSURE
"C" burner.
Impoverished Mixed Gas. 14·18 candles.
Same Gas with air 9·9 candles
Pure gas. Average actual efficiency per cu. ft. 11·11 candles
Gas & air " " " " " 16·75 "
DIAGRAM B.
"C"
Coal Gas 15·65 c.
Gas & air 12·92 c
Pure gas. Av. actual light 7·1 c. & 5·41 c. ft. · 13·1 c. eff'y
Gas & air " " 8·60 c & 4·53 " · 19·0 "
DIAGRAM D.
"C"
Mixed Gas 16·19 c.
Gas & air 15·60 c.
Pure gas. Av. light 5·67 c. & 4·91 c. ft. · 11·5 c. eff'y
Gas & air " " 7·09 c & 3·11 " · 22·8 c. "
DIAGRAM E.
"C"
Mixed Gas 17·35 c.
Gas & air 15·60 c.
Pure gas Av. light 6·6 7c & 5·174 c.ft. · 12·9 c eff'y
Gas & air " " 8·1·4 c & 3·740 " · 21·8 "
DIAGRAM G.
No 3. Kern with C mantle
Mixed Gas 17·36 c.
(b) Gas & air 14·88 c.
(c) ditto " but with air adjuster
Pure gas Av. light 8·8 0c & 4·11 c.ft. · 21·4 c. eff'y
b. Gas & air 9·5 0c & 3·76 " · 25·3 c "
c. " " 9·0 0c & 3·32 " · 27·1 c "
DIAGRAM H.
"C"
Rich Mixed Gas 18·3 c.
Same gas stripped by passing through hemp yarn saturated with Colza oil.
Quality 14·88 candles
Pure gas Av. light 4·9 c & 4·68 cu. ft. 10·3 c eff'y
Impoverished Gas 5·3 c & 4·80 " 11·3 c
Pure Carb. Water Gas 23·70c. by Cannel burner
By Argand (16 c Gas lts) 20·25 c.
Av. light 8·3·3 & 4·17 c ft. · 19·98 c eff'y
DIAGRAM K.
DIAGRAM I.

out in diagram form to clearly show the effect of this admixture of air with gas prior to reaching the burner. The pure gas results are shown by a continuous line; while those obtained with admixture of air and gas are indicated by the dotted line. It will be seen that it is far better to employ common coal gas than rich carburetted water gas of 23·7-candle value; so that the best use this latter gas can be put to is to enrich coal gas, and then diminish the quality to any desired extent by adding air. In this way a far higher value is obtained for it. Blue gas, or water gas proper, is of no use for incandescent lighting when employing the existing incandescent burners, as will be seen upon reference to Table I., Series L.

Referring to Diagrams B and I, it will be seen that a poor quality mixture of carburetted water gas and coal gas gives, with the "C" burner, almost a steady light, no matter how much gas is consumed; and therefore the efficiency decreases less per unit of gas burned than when using a rich gas, as indicated in Diagram I. By this, it does not follow that a better gas is the cheapest; by no means when consumed in the "C" burner. In fact, this rich gas gives better results after removing the bulk of the light-giving hydrocarbons, as is indicated (see Series C) by the dotted line on the left-hand side. Carburetted water gas of 23·7-candle power gives almost the same light as the 18·3-candle gas at 1-inch pressure, and with less gas when each is consumed in the incandescent burner. The carburetted water gas, instead of decreasing with an increase in the consumption, steadily increases; whereas the mixed gas decreases, simply because more air is required for its combustion than the burner will induct. The nature of the gaseous constituents is different.

In Diagram H, the finely dotted line indicates results obtained by using an air adjustor on the No. 3 Kern burner, thereby enabling one to adjust the amount of additional air necessary to bring about the best results with the least quantity of gas. The line is almost a straight one. At pressures of 3½ and 4 inches, the holes were wide open. Compare these results with those obtained by burning the same gas, but not allowing the air to mix with the gas other than by the usual intakes. In all cases it will be noticed a distinct reduction in the quantity of gas supplied, as well as a gain in the light emitted. The table below shows the comparative costs of the two methods of lighting per 1000 candles for one hour, with a "C" burner and mantle and at 2 inches pressure. The difference between the costs is far more marked when calculated from the results obtained at a higher pressure. Taking the cost of gas at 3s. 4d. per 1000 cubic feet.

	Pure Gas.		Gas and Air.
A.	3·63d.	..	2·41d.
B.	3·45	..	2·36
F.	3·03	..	1·68
G.	2·66	..	1·74
I.	4·00	..	—

In conclusion, the author summarizes the advantages of this method of incandescent gas lighting as follows: A greater inducement to the public to burn gas because of its cheapness. Low-quality gas made at the works by adding a percentage of air after purification to be much more efficient and economical than pure gas of whatever quality. Gas could be sold at a much lower price. No need to maintain a parliamentary standard of illuminating power above 10 candles. Such gas is suitable for all lighting, domestic, and industrial purposes. No need to alter existing manufacturing methods. No need for high-pressure gas for domestic lighting. Less leakage or unaccounted-for gas. And more acceptable from a hygienic point of view. The adoption of this method of supplying a cheap low-grade gas to the public would secure greater satisfaction, a more profitable return to the manufacturer, besides relieving him of the anxiety as to the maintenance of candle-power, and of purity.

SELF-INTENSIFYING OF GAS PRESSURE BY MEANS OF WASTE HEAT.

By C. Scott-Snell, of London.

The necessity for means of attaining pressure in the lamp itself was recognized by the author soon after taking up the study of intensified gas lighting. The compressor system involved a plant or equipment, and therefore caused an initial outlay which necessarily limited its sphere of application. The recognition of the want of such an invention was not any step in its solution; it was indeed already recognized by Lecomte, who placed a small water-injector (supplied from the city mains) in each lamp-post. On considering the selection of a force available to operate any intensifying appliance, waste heat was certainly obvious, and possessed the advantage of being free of cost; while neither drought nor frost would affect its efficiency. The utilization of the thermal force, however, involved great difficulties, if any of the most obvious methods were to be brought into operation. In no case could success be achieved if a motor driving a compressor was to be employed. The necessity for governing the speed and the pressure, the awkward accompaniment of a possible dead centre, troubles with lubrication, vibration, and many other obstacles arose, and reduced the question to a problem of a very difficult nature.

An appliance was required which should receive gas at normal pressure and deliver it at an increased pressure of 8 inches of water or more. (1) It must be operated by waste heat. (2) It must require no lubrication. (3) It must not have a dead centre. (4) No fly-wheel, slide valves, connecting rods, packed glands, or friction-producing appliances must be included. (5) It must be self-controlling. (6) Its cost must be low. (7) It must be simple in construction and easily adjusted. Such a programme of conditions and prohibitions seemed, at the first blush, to indicate that the problem could not be solved, except by some mystic appliance, such as the Keely motor, of American notoriety. By a certain line of reasoning, however, it was deduced that an invention using heat as a motive power was bound to include a displacer movement, as in every hot-air engine; and where two different pressures of gas were necessarily involved (a low inlet pressure and a high outlet pressure), check-valves were essential. It was easy to see that, by the movements of a displacer within a vessel heated at one end and cooled at the other, gas or air could be drawn in at one check-valve and ejected at the other, provided some agency could be found to operate the displacer without involving the use of the prohibited appliances above mentioned.

Those to whom the present arrangement in the lamp for overcoming such a difficulty is known, may regard the solution of the problem as very simple; but the introduction of the diaphragm (responsive to the variations of pressure within the displacer chamber), and its direct attachment to the displacer, is not on the ordinary lines of hot-air motor practice. Usually the displacer is operated in advance of the working piston, and involves certain secondary mechanism. It is difficult in designing to clear the mind of ordinary ideas of practice. The direct attachment of a displacer to a diaphragm—the weight of the displacer being taken by a spring—involves a curious condition of circumstances. It is natural to assume that heat being applied to the bottom of the vessel or container, expansion of the confined gas will take place (in pressure limited by the weight on the outlet valve, which will act as a safety valve as it were), and the responsive diaphragm will lift the displacer until all the gas collects below the displacer and against the hot lower plate. The displacer would then apparently be retained at the top of its stroke until the expansive action of the gas was exhausted and the pressure fell, thus allowing the displacer to come down again. This action, however, would be too slow for practical purposes, and, moreover, never does obtain in practice, as will be seen later on.

The conditions under which the apparatus operates are as follows: The vessel is charged with gas, one half of which (the upper) is at a moderate temperature—say, 80° Fahr.—the lower half being perhaps at 500° Fahr. Now such a state may be quite consistent with perfect equilibrium of pressure throughout all the gas in the vessel. It may also be consistent with a flow of gas entering at the inlet valve, going across the chamber, proceeding through the outlet valve, and on to an incandescent burner or elsewhere. The condition of equilibrium under such circumstances is, however, very unstable; the slightest movement of the displacer, either up or down, would obviously lead to a transfer of cold gas to the hot side, or of heated gas to the cold side, as the case might be, and this would be followed instantly by contraction or expansion, tending to produce a change of pressure in the chamber.

Diagram 1 (p. 1730) shows a displacer chamber viewed as gas is going through, but no heat applied; the displacer movement therefore produces no effect on the gas. Diagram 2 shows the displacer at mid-stroke. Diagrams 3 & 4,

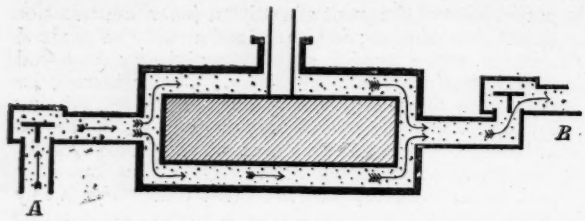


DIAGRAM 1.—Showing displacer chamber with check valves, no heat applied, reciprocation of displacer has no effect on gas.

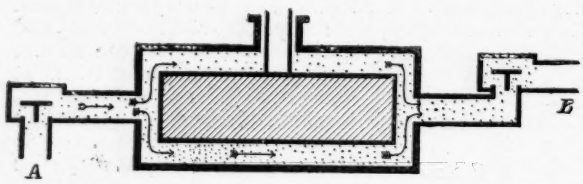


DIAGRAM 2.—Showing displacer at half-stroke and heat applied to base of chamber. A film of cold gas passes over the top of displacer and a film of hot gas passes under the displacer, but equilibrium of pressure is still maintained.

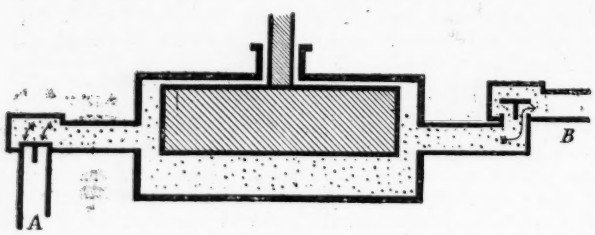


DIAGRAM 3.—Displacer raised, gas transferred to hot section. Expansion closes valve A, and drives gas out at B.

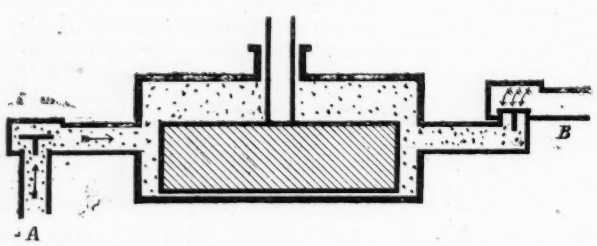


DIAGRAM 4.—Displacer depressed, gas all transferred to cold section. Contraction causes partial vacuum, gas rushes in at A, while B is closed by back-pressure.

with the notes appended, illustrate the conditions which follow movement after heat is applied. Diagram 5 illustrates essentially the conditions which obtain when a diaphragm is attached to the displacer rod and made responsive to the variations in pressure in the chamber. With this construction before us, the action may be readily followed. For clearness, let us assume the displacer to be slightly, yet quickly, lifted. It follows that a quantity of cold gas is added to the heated section and caused to expand. Such expansion stops the inflow from the gas supply, by reason of the rise of pressure acting on, and closing, the inlet valve; it also causes a blow out through the outlet valve. Most important of all its effect is felt on the diaphragm, which, by its consequent movement, still further lifts the displacer, and drives more cold gas down to the hot side. This, therefore, by expanding, causes the initial lifting power to be reinforced, until a full stroke or travel is attained. As the gas, after passing the outlet valve, goes to the pinhole in the nipple, the rate of discharge to the atmosphere is comparatively limited, and pressure therefore increases rapidly in the intervening pipe and reservoir.

At the beginning of the upward motion of the displacer, the spring to which it is attached counterbalanced gravity, but towards the end of the upward stroke, the spring has ceased to do so to any great extent. A point is therefore reached where the loss of assistance from the spring allows gravity to assert itself until it exactly equals the lifting power on the diaphragm. This would mean stoppage of further movement, and be equivalent to a "dead centre;" but the momentum of the displacer coming into play, makes the travel extend beyond such a critical counterbalancing position. At this point, the peculiarity of the diaphragm has to be considered. It was in a position giving maximum lifting area at half-stroke; but its effect becomes rapidly diminished as it blows out. So that, as the displacer lifts, not only is the counterbalancing effect of the spring becoming more feeble, but the effective area of the diaphragm is also diminishing; hence the displacer, once in motion, will always travel beyond the point of equilibrium of the various forces, on account of its momentum.

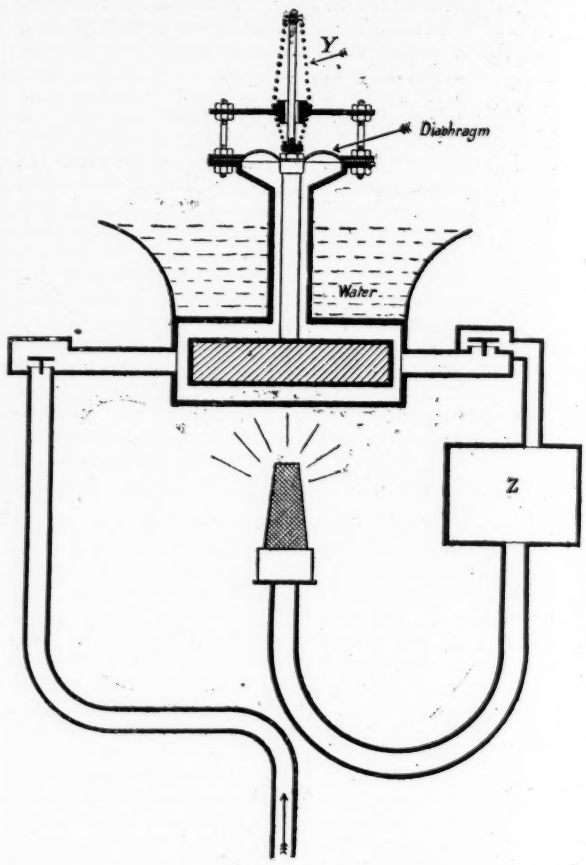
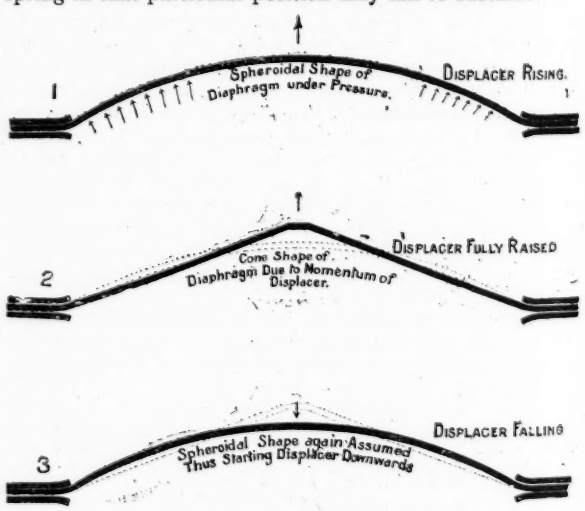


DIAGRAM 5.

The reaction, when the momentum is exhausted, is that due to gravity; and the displacer will naturally tend to fall back to such a point that the effective area of the diaphragm, multiplied by the pressure in the vessel, would counterbalance the gravity effect, or such amount as the spring in that particular position may fail to sustain.



DIAGRAM

This point, if reached in practice, would mean, as it were, a "dead centre" on the down stroke. But such a trouble is avoided, because, when the displacer commences to fall, it also begins to transfer a part of the heated gas below it to the cold section above it; thus starting condensation

and rapidly reducing pressure until a partial vacuum is set up, which increases in intensity as the displacer falls. Therefore, not only has the upward pressure on the diaphragm been destroyed, but a positive downward atmospheric pressure, tending to depress the displacer, has been substituted, which rapidly drives down the displacer to its utmost limit. In being so depressed, however, the displacer is causing abnormal compression of the sustaining spring, until its momentum becomes absorbed thereby. The diaphragm at the same time, by its motion below mid-stroke, is lessening in effective area, and therefore in depressing power. Another result also taking place at the same time is that the condition of partial vacuum set up by the depression of the displacer is causing a rapid influx of gas through the inlet-valve, which quickly overcomes the vacuum and relieves the diaphragm of atmospheric pressure.

The displacer at its ultimate downward limit is therefore subject to the following conditions: There is no downward force on the diaphragm. On the contrary, the influx of gas, at the pressure of the gas-main, is tending to lift it. Further, the spring, being abnormally compressed, is also tending to lift the displacer back to mid-stroke. All forces have therefore become reversed in direction, and a lifting power is in operation. Upon its way back to mid-stroke, at which the displacer would nominally come to rest, it causes a transfer of cold gas above it to the hot section below, and therefore the diaphragm, with an increasing effective area to act upon, is made subject to upward pressure, and the cycle repeats itself. The movement is therefore due to a sort of "hunting" effect, and results in a reciprocation of the displacer, at the rate of 120 cycles (up and down movements) per minute.

The peculiar action of a flexible diaphragm is interesting, and is illustrated in the diagram. A study of this will show that the diaphragm not only has a rapidly diminishing effective area as it gets extended, but that it seems to give a sharp reaction after causing the displacer to lift to its full limit. The momentum of the displacer causes the diaphragm, after blowing out in a spherical shape, to assume a conical form, which is, of course, contrary to its condition of equilibrium under pressure. In attempting to re-assume a spherical shape, it therefore draws the displacer downwards. Pressure on the diaphragm thus causes the displacer not only to be driven to the full extent of its up stroke, but also part of the way in the reverse direction. A spring is arranged under the bridge carrying the displacer sustaining spring to admit of an adjustable check to the momentum, and to start a rapid downward action in the event of the diaphragm being so stretched or slack that the cone shape is not reached when the displacer has attained its full stroke.

Such an apparatus as described constitutes a reciprocating engine which: (1) Has no piston, yet compresses the contents of the gas-chamber; (2) has no slide-valve, yet preserves a perfect cycle; (3) has no fly-wheel, yet cannot stop on a dead centre; and (4) has no governor, yet accommodates its beat to the demand for gas. This last advantage is of very considerable importance; the rate of reciprocation being, in fact, according to the size of the gas-nipple. For instance, a lamp may have but one burner and have a rate of 120 cycles per minute; but if three nipples be used, as for cluster work, the lamp will operate with greater rapidity, delivering three times the volume of gas, and, of course, it will have the waste heat from the three burners to energize it. Here it is interesting to note that the size of displacer, 6½ inches diameter by ¾ inch stroke, at present in use for one burner will supply three burners if needed.

It has been shown that the displacer in the heated lamp, once put in motion, will preserve its cycle. The reasons for self-starting may now be investigated. If the valves be made of such a weight that they are lifted by the normal gas pressure, it will be found that two valves, when in series, chatter on their seats, and tend to set up a variation in pressure, or vibration, in the displacer-chamber, which, being felt on a sensitive diaphragm, communicates motion to the displacer, and causes a slight dancing of the displacer on its spring. But we have already seen that any movement from mid-stroke, when a lamp is lighted, tends to become amplified by the change it brings about in the internal pressure. Therefore any small initial movement, as the difference in temperatures between the top and bottom of the chamber becomes pronounced, will rapidly grow, and lead to the attainment of a full stroke. Another form of valve—and this is the type best adapted for starting—is a heavier kind, which will not allow gas at the normal pressure of the mains to find its way to the nipple by passing through the displacer-chamber.

In this case, an appliance called a "reverter" is used. It may in brief be described as an automatic bye-pass, whereby the Bunsen burner is heated by low-pressure gas until the intensifying commences, after which the lamp runs on high-pressure alone. The introduction of this appliance enables heavy or spring-loaded valves to be used, yet maintaining a good light at the burner. The lamp can thus be started without trusting to the chattering of light valves to affect the displacer through the diaphragm vibrations. The effect of heavy valves is as follows: When the lamp is cold, the displacer-chamber necessarily contains an initial charge of either gas or air at atmospheric temperature. On heat being applied to the bottom of the chamber, the expansion caused thereby increases the pressure to an extent determined by the weight of the outlet valve; and it is this pressure transmitted to the diaphragm, which, of course, causes the displacer to be raised, and thus begin the cycle of movements already explained. Valves, if allowed to get dirty, prevent this initial pressure being achieved, on account of want of tightness. Such neglect does not prevent the lamp being started, as will be explained later on; but self-starting becomes spoiled.

Referring to the reverter (diagram No. 7), gas at low pressure enters at A, and, the float being down, finds an exit up the centre hole B and the side hole C. From the latter, it issues at the side apertures X and Y. The total gas aperture area for low pressure therefore consists of

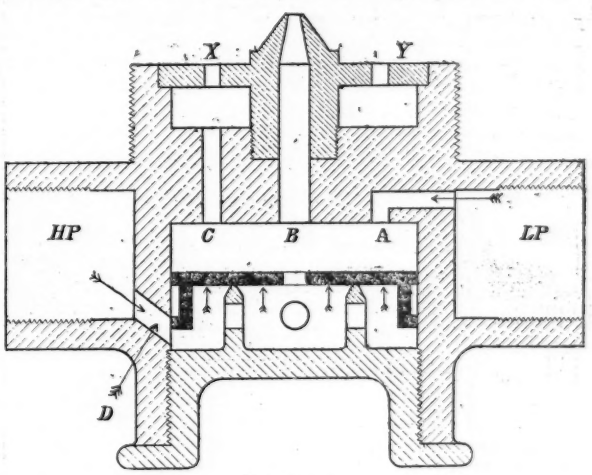


DIAGRAM 7.

the openings X, B, and Y; and while B is a standard aperture, and must not be touched, X and Y may be opened out, if necessary, to suit a very low local gas pressure for the lamp when in use as an ordinary low-pressure lamp. A channel D makes a connection (under the float) with the high-pressure pipe; and when the heat has taken effect on the intensifying chamber of the lamp above, to which the pipe is connected, the cycle commences, and delivery under pressure ensues. The rapid flow of gas which follows, lifts the float and closes the low-pressure aperture A, as well as the hole C, whereby only the standard opening B is left at work. Should the lamp cease its action from any cause, or be cut off by a special tap provided on the lamp, and the supply of high-pressure gas cease, the float will fall, thereby restarting the supplementary feed apertures, and maintaining a good light, even at low pressure. The aperture B alone would give but a small light, and take rather longer than desirable to heat up and start the lamp, if not supplemented by the feed from the additional holes X and Y.

The form of reverter above described has been modified to admit of easier attention to internal parts, which has been effected by subdividing its functions. The bye-pass arrangement is worked by a separate disc apart from the float (see section in diagram 8). It will be noticed that the governor stands immediately over the bye-pass valve, and the "aperture controlling float" is immediately under the burner; the whole being in one vertical line. They may be replaced or examined very easily by unscrewing

the top of the bye-pass valve and removing it with all the appertaining parts mounted upon it. A point not to be overlooked in burning heated gas is that the nipple area requires adjustment. For instance, gas burning at 250° Fahr. temperature will be expanded probably 30 per cent. over its original bulk when it was admitted to the lamp. The

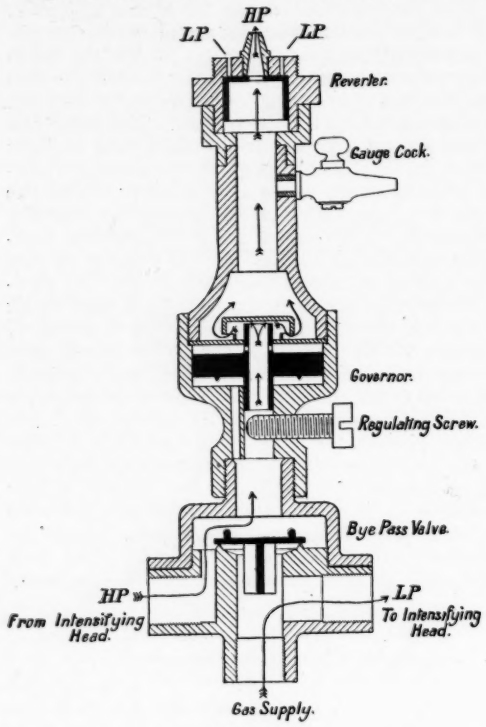


DIAGRAM 8.

nipples therefore require slight enlargement over cold-gas nipples. This admits of greater velocity of delivery, and therefore a sharper blast for drawing air into the burner.

It might be imagined that the process of maintaining a water-charged head to each street-lamp would involve a certain amount of trouble with ladder and bucket; but in practice it is dealt with in an extremely simple manner. A hollow shepherd's crook is hooked into the water-filling aperture, and by a rubber attachment to a hand-pump the water is delivered until it overflows. By such an appliance, and the use of the municipal water-cart, it would take very little time to charge 100 lamps.

In considering the question of evaporation, some changes have been made from the original design. At first the desire to prolong the water-filling intervals led the writer to take special precautions to prevent the temperature of the water reaching such a point as to cause visible evaporation. Readers of the gas papers will remember a diagram of one of the early lamps showing low ultimate temperature; but as the operation of refilling is so simple, he has preferred to re-arrange the lamp more with a view to getting at every part than in prolonging the intervals of water filling. The glass-cleaning attendant can readily insert a wooden rod, perhaps once a month, or (say) when replacing the mantles, and see by the wetted surface how far the evaporation has reduced the water level. Again, in hotter countries, such as India, it would need extra precautions to counteract evaporation; and refilling is so simple that there is no justification for their introduction. All lamps are tested to see that, with a maximum possible water temperature (212° Fahr.), the pressure is such as to give an ample margin over that required at the burner. It is unnecessary to point out that the pressure in the lamp-reservoir is a matter of difference of temperature between the hot and cold sections of the lamp. A frozen water head would give pressures of probably 45 inches in the reservoir; while the same lamp, filled with boiling water, might fall in reservoir pressure to 20 inches. The Peebles governor would still maintain the nipple pressure at 8 or 10 inches throughout; so that no inconvenience occurs from change in reservoir pressure.

It has been pointed out that dirty valves may prevent a lamp automatically starting. The possibility of dirty valves is due to the heated gas in newly-made lamps vaporizing the grease in the pipe joints (they are made with graphite); but this disappears in due course—the lamps, in fact, improve by use. Each lamp is provided with a starting device, which enables the attendant, by pulling a light chain, to cause a pulsation of the gas in the displacer

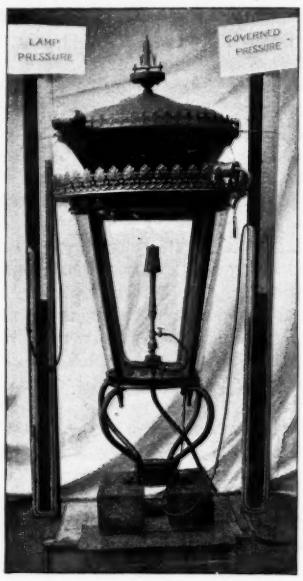


FIG. 1.—Photograph of lamp actually running, but without mantle. Governed pressure, taken by gauge attached to cock between governor and nipple, 8½ inches. Pressure in lamp reservoir, taken by gauge attached to cock at head of lamp, 27½ inches.

chamber; so that the lamp then enters into the intensifying stage, if sufficient heat has accumulated at its base. Some of the lamps have been put to the test of continuous operation day and night for 160 consecutive hours, besides subsequent runs of 128 and 123 hours continuously, and the interior has then been found in good condition;

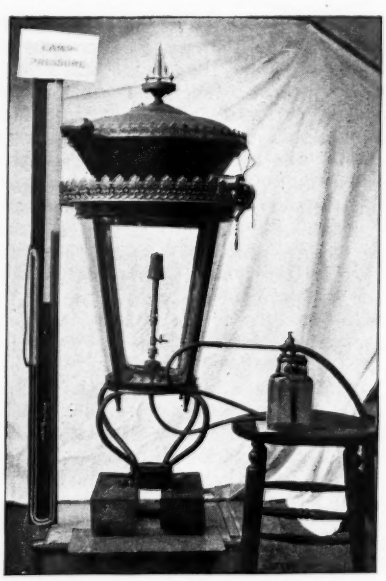


FIG. 2.—Photograph of lamp actually running, but without mantle. Gas enters water seal by the large rubber pipe ending in a vertical tube to bottom of glass jar. Lamp is sucking through thin metal pipe projecting horizontally and sealed into head of jar. A bye-pass valve cuts out the water seal to admit of temporary gas supply for starting lamp. This is then closed, and the lamp draws through the seal. The gas-supply pressure is 2 inches, water seal 4 inches deep, actual water sealing therefore 2 inches. Lamp-gauge is reading 13 inches.

no deposit of naphthalene being discovered. Indeed, it appears doubtful if such could exist in a lamp where the general temperature is so much above the normal. A photograph is here reproduced of a lamp drawing through a water seal of 4 inches; the normal gas pressure being 2 inches. The lamp is therefore sucking gas against a

seal of 2 inches. This is interesting, as showing that these lamps will run on the very lowest gas *pressures*, provided there is plenty of *volume* available. The supply-pipe should never be less than ½ inch in diameter, as the double reciprocation of the displacer is at the rate of 120 per minute, or only half-a-second for the complete cycle of

FIG. 3.—Elevation of lamp in square lantern, showing inlet valve with starting device on one side, and outlet valve with connection to reservoir on the other side.

drawing in a gas charge, heating, expanding, and ejecting it. If, then, a lamp be feeding a 540-candle power burner with 15 feet of gas, it will deal with over 3½ cubic inches of gas per cycle; and, at 120 cycles per minute, not more than a period of a quarter-of-a-second at the outside is available for the drawing in of the gas charge.

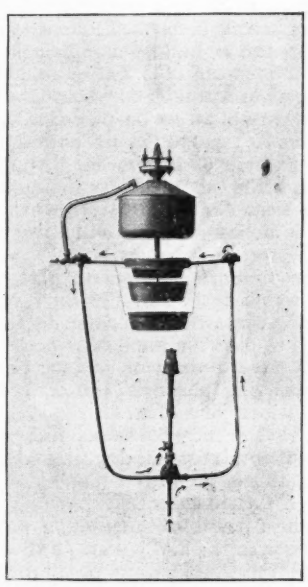


FIG. 4.—Rough skeleton of lamp (lantern, reflectors, &c., removed) showing simplicity of vital organs. Arrows show course of gas through pipe to inlet valve, onward to intensifier, out through outlet valve, and down to burner. Connection to reservoir above is also shown. The hot dish is suspended over the burner, the displacer dish, which nests into it, is shown immediately above, and the cold dish, which also rests into displacer is shown with valve pipes attached. When the hot and cold dishes are clamped flange to flange, the displacer has a vertical movement of about ¾ inch.

As evidence of the extent of improvement effected in gas lighting devices, it is of interest to note that the step up from a 15-candle power batswing burner giving 3 candles per foot, to a self-intensifying lamp giving 540 candles from a single burner, is as follows: The efficiency is increased 12 times. The unit of light is increased 36 times. These results are of some significance in the competition with electricity. Expressed in other words, it may be said that gas enters the lamp having a value of 2s. 6d. per 1000 cubic feet; but the light attained gives such service that it is equivalent to reducing the price of gas to 2½d. per 1000 cubic feet.

Of course, there is nothing even now (beyond inconvenient size of mantle) to prevent a much larger unit of light being attained. The author expects, in fact, to get shortly a unit of 1000-candle power without very material changes in the mantle dimensions. Foreign laboratories have reported the lamp as giving 38½-candle power per cubic foot; and with certain other adjustments specially suited to the conditions of gas consumed hot—in which the lamp now described differs from any other pressure system—40-candle power per foot will probably be attained. A burner using 25 cubic feet would then give 1000-candle power at the mantle; and the writer does not think that the diameter of the mantle for such a light would be increased as much as an inch beyond the present 300-candle power mantles.

The large unit of light from a single mantle, of course, reduces the number of mantles required to light a given length of street, and reduces the number of pilot lights to the same extent; it therefore economizes expenditure where such economy is at present most required. For instance, in mantles, five burners of 100-candle power each would involve a greater charge for renewals than would one lamp with a single mantle of 500-candle power.

The pilot light, if in use for 16 hours per diem, will consume (say) ¼ cubic foot per hour, 4 cubic feet of gas.

If used on a burner consuming 4 cubic feet per hour, and burning 8 hours per diem, the pilot light will add 12½ per cent. to the gas bill, or equivalent to one hour extra lighting.

If used on a high-pressure burner consuming 10½ feet per hour, the pilot will add not quite 5 per cent. to the gas bill, or equal to 23 minutes' extra lighting.

With a two-burner lamp giving 1000-candle power, and using 30 feet of gas, the pilot will only add a little over 1½ per cent. to the bill, or equal to 8 minutes' extra lighting.

As large unit lights are relatively so far apart, and the pilots are so much reduced in number per unit length of street, it is therefore a matter of no material economy to dispense with them; on the other hand, the life of the mantles would be prolonged by avoiding the jar involved in torch insertion into a lantern.

With the competition of rival illuminants, it is interesting to make calculations of the cost of lighting per 1000-candle power with burners giving 35-candle power per foot of gas; and the writer does not feel that the gas industry is moribund in street lighting when it is able from its mains already laid, at the bare cost of a self-intensifying lamp (no other capital expenditure being involved), to produce a unit of light comparable with any rival, and free from many of the drawbacks of other illuminants.

Waste heat is therefore a valuable product, raising the light-giving power of the gas from 20 or 25 candle power per foot, to 35-candle power per foot, or equivalent in effect, let us say, to reducing the price of gas in incandescent lighting from 3s. to 2s. per 1000 cubic feet.

Discussion.

Mr. R. G. SHADBOLT (Grantham) said he had not the pleasure of hearing Mr. Sugg's paper, so he could not refer to it; but with respect to the Scott-Snell lamp, he might say that he had had one under observation for three months, and was most pleased with it. The destruction of mantles was not very excessive—being some ten a year, or about double the number used in the ordinary lamps. Considering the lamp was in the experimental stage, and that there was a great amount of vibration, he thought this was very good. The light was very satisfactory, though he had not tried it in the photometer. The effect at night was most marked; and it certainly put all the other lights to shame. There had been no difficulty, except with starting, which at present seemed to be the weak point. He was informed by the makers that they had overcome this difficulty to some extent by displacing the leather diaphragm by one of balloon silk; but, according to the paper, there was some light chain-and-hook arrangement for starting introduced, so that it appeared the difficulty was not quite surmounted. He found that occasionally it would start itself, but not always. Coming to Mr. Grafton's paper, he took more

interest in it, because, by a peculiar coincidence, he had been working on almost parallel lines during the past winter. This intensified lighting interested gas engineers very greatly; and, like many others, he had been puzzled by the different statements made at various times as to really what was the vital cause of the intensified light. In cogitating over it, he conceived an idea, which might not perhaps be original, but which led him to make experiments on almost parallel lines to Mr. Grafton's. The first thing which struck him in looking at the paper and the tables was that all the best results were at what were comparatively high pressures—2 inches and over. It was astonishing what good results one could get over 4 inches pressure with an ordinary Kern burner under everyday working conditions; and that was a pressure Mr. Grafton looked on as being comparatively low. It might be in London; but it was not in the Provinces, where 4 inches was considered high. Looking over these statements, the higher or better results, even with the air admixture, were obtained at a pressure higher than 2 inches; but another thing which struck him was that the burner adopted as the standard of comparison was the "C" Welsbach. The author had given some results and tests with a "C" burner, and some with the Kern; but at the end of the paper, where the economical result was shown by comparison, it was based on the results obtained from the "C" burner only. He thought it would have been better to have taken the Kern burner as the standard, for it was undoubtedly the standard burner to-day, and it gave a higher duty under normal conditions than the "C" burner. For instance, looking at Statement No. 1, there was only one set of tests which was really comparable in the entire series—viz., G. The mixed gas was 17·35 candles; and by the addition of air, it was reduced to 15·60 candles, used first in the "C" burner. Immediately following, they found the same gas tested in the Kern. He had totalled the results in each line from left to right where the pure gas and mixed gas and air were shown, and compared the two burners. The result was as follows: The "C" candle-duty with plain gas on the total average from left to right was 12·26 candles per cubic foot; with air and gas mixed, 22·99 candles—showing an increase in favour of the admixture of air and gas of 10·73 candles. Applying the same method to the Kern burner, he found the efficiency there with plain gas was 16·22 candles, as against 12·26 candles with the "C" burner; and with air and gas mixed, 24·26 candles, as against 22·99 candles—giving an increased duty of 8 candles, against 10¾ candles with the "C" burner. Unless, therefore, Mr. Grafton had some other reason for taking the "C" burner exclusively, it would have been a little better if the comparative economy had been based on the Kern results. Again, turning to the diagrams he found, roughly speaking, the result was this: In Diagram B, the pure gas gave 11·11 candles daily and the mixture 16·75 candles. In the next one, it was 13·1 candles with pure gas, and 19 candles with the mixture; in the next, 11·5 candles with pure gas, and 22·8 candles with the mixture; the next was 12·9 candles with pure gas, and 21·8 candles with the mixture. All these were with the "C" burner. Then coming to the Kern burner, he found that the efficiency under normal conditions, without previous admixture of air, was 21·4 candles per foot, which was almost equal to the highest result obtained with the "C" burner with the air and gas mixed. So that if the Kern burner had been taken as the standard, instead of the "C," it would have materially reduced the saving shown. The conclusion he arrived at was that, with the application of air, the improved results achieved were only partial. Some little time ago, he read about something of the same kind in Germany, where two drums were attached to one shaft in the usual plan, and the gas actuated the other drum in the well-known way, and introduced a certain proportion of air. The mixture of gas and air then went on to the burner together. It was quite evident, therefore, that there had been brains at work in Germany on much the same lines as in England. The results obtained there he could not make out. They averaged about 16 candles per foot; but there was no indication as to the quality of gas used, so that it might have been very low. At any rate, the same principle had certainly been applied, of providing and distributing a mixture of gas and air. His own experiments had been of this kind. His idea was that, considering that the preponderating part of the mixture in a bunsen tube consisted of air, if it were at all necessary to use pressure to obtain an intensified effect, why not deal with the air and take the gas at the pressure at which it happened to be distributed? He thus reversed the order of things by utilizing the air-jet instead of the gas-jet, and introduced the gas instead of the air by the side-holes. He took two burners of the injector type, with removable tops, so that for testing the top of the burner the mantle might easily be removed from one to another without damage. One he would call the intensifier, which was modified in accordance with this idea; and the other, the ordinary burner. Taking "C" street mantles (which were certainly not the best for illuminating effect, but which were the most durable), two mantles were burnt off—one on the intensifying burner, and one on the ordinary. Then, after 24 hours' burning, they were subjected to photometric tests against a 23-candle argand standard. The 23 candles were secured by using an argand burner with the largest chimney he could get attached to it. Of course, he was pinned down to the usual 60-inch photometer. Taking hourly consumptions of from 3 to 10 cubic feet, and taking first of all the ordinary burner and testing it with its own mantle, the duties ran, per cubic foot of gas consumed of 17 to 17½ candle gas, from 22·6 candles with 3 cubic feet, to 10·46 candles with 10 cubic feet per hour. With the mantle burnt off on the intensifying burner, the duties ran from 19·93 candles at 3 cubic feet, to 9·2 candles at 10 cubic feet per hour. Reversing the order, and taking the intensifying burner at 3 cubic feet per hour, the duty given with its own mantle was 19·32 candles per cubic foot; and with a consumption of 10 cubic feet, 35·65 candles, or a gradually increasing duty per cubic foot in proportion to the increased consumption. Taking the mantle burned off on the ordinary burner, 3 cubic feet per hour gave a duty of 20·7 candles, and 10 cubic feet a duty of 30·75 candles. These were the results of tests with a "C" mantle. Taking the special mantle made for this particular burner, and usually supplied with it, he adopted the same method again. Three cubic feet per hour gave 23 candles per foot, and 10 cubic feet per hour 9·20 candles—very similar to the "C." With the intensifying burner under the same mantle, the duty for 3 cubic feet per hour was 19·5 candles and for 10 cubic feet per hour 33·92 candles, which was practically the same as the "C;" if anything, a little better. To come to another comparison. Hitherto the air had been supplied to this intensifying burner at a pressure of 6 inches, and the jet-nozzle had been increased in diameter to about $\frac{7}{16}$ inch, to allow the requisite quantity of air to be passed at that pressure. The next step was to remove the jet entirely, and supply the air at the full bore of the burner bottom, which was equal to a $\frac{5}{8}$-inch brass tube. Under these conditions, the results obtained were almost identical, when the air was supplied under 6 inches pressure and when the pressure was very much lower. With an hourly consumption of 3 cubic feet, the pressure required to pass the requisite quantity of air was 1-10th, and the duty per foot 16·48 candles. Running upwards to 10 cubic feet per hour, the pressure required to pass the requisite quantity of air was 10½-10ths, which gave a duty of 33·92 candles per foot. So that for intensifying purposes, the air pressure under 6 inches with a $\frac{7}{16}$-inch jet and an air pressure of 10½-10ths with a full bore, gave exactly the same illuminating results. It was a case of admixture and nozzle velocity, rather than of velocity at the jet with either air or gas, as the case might be. Further than that, he thought he would ascertain the highest possible illuminating power he could squeeze out of the mantle; and he ran up the consumption foot by foot until the illuminating power began again to fall—increasing the pressure on the test holder to provide sufficient air for each cubic foot increment of gas. The result was that the maximum duty was obtained by a consumption of 18 feet per hour. The pressure required to pass the air to consume this was 32·10ths, and the total illuminating power was 678·5 candles, or a duty of 37·69 candles per foot. It was a remarkable coincidence that this was the exact duty obtained by Mr. Grafton with a special burner, under a 9 inch pressure of gas, when he blew his mantle away, which he also did at the third test. The mantle stood three separate sets of tests at intervals of half-an-hour; and during the third it entirely vanished. Another feature of these tests was the proportion of air required to effect the results. They had no chimney, of course. It was a naked mantle. He took a set of observations when obtaining the highest light duty from

a given consumption; and the proportion of air to gas when intensifying ran out as follows: With a consumption of 4 and 5 cubic feet per hour, 4·7 feet of air to 1 foot of gas; 8 cubic feet per hour, 5·8 feet of air to 1 foot of gas; from that to 10 cubic feet an hour, 6 feet of air per foot of gas. So that really intensifying the light was more a question of concentration. They might consume in a given burner 5 cubic feet of gas, filling the mantle, and getting a fair duty. They might increase the consumption, irrespective of the mantles and lighting, up to 30 cubic feet an hour; and by increasing the proportion of air as required they could bring about combustion in exactly the same space that the 5 cubic feet took up in the first instance. This appeared to him to be clearly the principle of intensifying incandescent lights—rapidly increasing combustion up to a certain point, beyond which, of course, the mantle would not stand it. Mr. Grafton required a motor, after all, to introduce the air into his gas, although he introduced only a small proportion. The advantage was that he got a thorough admixture, which was the chief point. The question of admixture was the great factor in successfully intensifying lighting; but no more would be required for the method he had suggested. He might say that this was not a trading speech. He was not going to float a company to exploit the invention; he was simply giving them what information he could. It appeared to him that no more motive force would be required to compress the air to a pressure of 10½-10ths than would be needed in Mr. Grafton's case, because, as he said, they must have a pressure of air greater than the gas, in order to inject it. The only difference appeared to him to be that in Mr. Grafton's case he had gone part of the way; and in his own case he made the air the prime mover, and provided all the air required inside the burner.

MR. SHADBOLT'S EXPERIMENTS IN INTENSIFYING

[Gas 17 to 17½ candle power.]

TEST No. 1.—*Ordinary Injector Burner, with "C" Welsbach Street Mantles.*

(*a*) Mantle burnt off in position.
(*b*) " " on intensified burner.

Hourly Consumption in Cubic Feet.	Illuminating Power in Candles.		Candle Duty per Cubic Foot of Gas per Hour.	
	(*a*)	(*b*)	(*a*)	(*b*)
3	67·85	59·80	22·62	19·93
4	80·50	55·20	20·12	13·80
5	74·75	51·75	14·95	10·35
6	73·60	54·05	12·26	9·00
7	74·75	57·50	10·68	8·21
8	80·50	65·70	10·05	8·33
9	93·15	80·50	10·35	8·94
10	104·65	92·00	10·46	9·20

TEST No. 2.—*Intensifying Burner, with 7-16ths Inch Air-Jet and Gas Supply at Side, and "C" Welsbach Street Mantles.*

(*a*) With its own mantle.
(*b*) With mantle burnt off on ordinary burner.

Hourly Consumption in Cubic Feet.	Illuminating Power in Candles.		Candle Duty per Cubic Foot of Gas per Hour.	
	(*a*)	(*b*)	(*a*)	(*b*)
3	57·96	62·10	19·32	20·70
4	58·65	78·20	14·66	19·55
5	92·00	81·65	18·40	16·33
6	156·40	115·00	26·06	19·16
7	209·76	150·65	29·96	21·52
8	244·25	209·76	30·53	26·22
9	301·76	244·25	33·53	27·14
10*	356·50	307·51	35·65	30·75

* Maximum air supply at 6 inches pressure with intensifying burner.

TEST No. 3.—*Ordinary Injector Burner, with its own Special Mantle.*

(*a*) Mantle burnt off in position.
(*b*) Same mantle on intensifying burner.

Hourly Consumption in Cubic Feet.	Illuminating Power in Candles.		Candle Duty per Cubic Foot of Gas per Hour.	
	(*a*)	(*b*)	(*a*)	(*b*)
3	69·00	58·65	23·00	19·55
4	78·20	76·15	19·55	17·54
5	67·85	95·45	13·57	19·09
6	69·00	110·40	11·50	18·40
7	70·15	161·00	10·02	23·00
8	69·00	216·20	8·62	27·02
9	79·35	299·00	8·82	33·22
10*	92·00	339·25	9·20	33·92

* See note to Test No. 2.

TEST No. 4.—*Special Mantle, as Test No. 3.*

Air nipple in intensifying burner removed, and air supplied through full bore of connecting pipe—*i.e.*, ⅜ inch diameter.

Air Pressure in Tenths of an Inch.	Hourly Consumption in Cubic Feet.	Illuminating Power in Candles.	Candle Duty per Cubic Foot of Gas per Hour.
1	3	49·45	16·48
2	4	71·30	17·82
3	5	89·70	17·94
4	6	108·10	18·01
6	7	161·00	23·00
7·5	8	213·90	26·73
9·5	9	278·30	30·92
10·5	10	339·25	33·92

EXTRA TEST *for Maximum Luminosity Obtainable from One Mantle.**

32	18	678·50	37·69

TESTS *of the Proportion of Air to Gas when the Intensifier was Giving the Best Results.*

At 5 c. ft. gas per hour = 4·7 c. ft. air per foot of gas.
" 8 " " " = 5·8 " " " "
" 10 " " " = 6·0 " " " "

Mr. T. CANNING (Newport) said he hoped they would be able to get some more information from Mr. Grafton. He would not attempt to discuss the two papers by Mr. Sugg and Mr. Scott-Snell, as he did not feel he could offer any criticisms upon them until he had had an opportunity for further study. He would only say that they dealt with points of the most vital importance to the gas industry. With respect to Mr. Grafton's paper on the effect of quality and pressure on the efficiency of incandescent gas lighting, to some extent it was unsatisfactory, because it seemed to deal with quality, pressure, and efficiency in incandescent lighting as if they were the only factors in the question—as if they had already on the market a satisfactory burner and a satisfactory mantle, neither of which, as he thought, they had. It also seemed to be a plea for low-grade gas; and although at Newport the Gas Company had in charge several thousands of incandescent gas-mantles, which they replaced at a very low charge, and although they had introduced incandescent lighting to a large extent (having to compete with electricity in the town), still, for all that, there was a vast number of people to be taken into account—probably the larger part of their consumers—who would adhere for many years to come to other forms of burners. If any gentleman present, following Mr. Grafton's suggestion, and getting enthusiastic about it, should return home and at once introduce low-grade gas in his district, if he had a particular fancy for having special prayers put up for him on the next Sunday, he had no doubt he would have them, and he dared say he would deserve them. There were certain conditions necessary in the burner; but Mr. Grafton made clear the main point in all incandescent gas lighting, and that was the perfect combustion of the gas at the point of ignition. Although calorific value had a great deal to do with this question, he might put it in a short form, and say that it was intensity that rendered the mantle luminous; it was not calorific value spread all over the surface, but concentration, so to speak, of the calorific power. He did not know that they ought to dwell too much on that, because it might be possible in years to come that there would be introduced, as the photometer was introduced in the last century, a calorimeter or pyrometer for the purpose of testing, to see whether the gas was made of a fixed calorific standard; and this whether it was high grade or low grade, water gas, oil gas, or coal gas. But he should hope this would be strongly opposed from the beginning by the whole profession. When the photometer was imposed, they could all remember that they had a monopoly of some sort; but to-day they could not say they had a monopoly. The gentleman who supplied them with coal or oil was under no test of any kind; and they had only to arrange with him under the common law. They had a statute enacted for the purpose of keeping them right; but, in his opinion, the day was gone by for that necessity, and they ought to come under the common law only. This had an important bearing on the question of introducing low-grade gas. There were one or two points as to the possibility of a complete mechanical mixture of the gas and air before

* The mantle stood three separate tests at intervals of half-an-hour, and afterwards vanished.

ignition, which he should like to refer to—for instance, the amount of heat applied to gas before its combustion. He had listened with great attention to the eloquent speech of Mr. Shadbolt; and, if he followed him, that was the point where he would find the greatest difficulty—namely, the cooling effect which his method would produce. A good deal of the efficiency of the Kern burner was due to the manner in which the heat was utilized for the purpose of regeneration. Mr. Grafton said: "It is not to be understood that unburnt gases pass away; but those products have not been burnt quickly enough in order to get the greatest heat in the vicinity of the mantle fabric to be heated to incandescence." This was perfectly correct, and it was a very solid observation. They must have the heat in the vicinity of the mantle—in fact, the mantle must be immersed in what he might call the zone of highest calorific intensity; otherwise the result was bad. This had a great deal to do with the efficiency of incandescent lighting, and introduced other questions—namely, the surface of the mantle relative to the mass, and also the form of the mantle. A very particular point was the position of the axis of the mantle in relation to the axis of the flame. To put it shortly, the axis of the flame and of the mantle must be identical, and must be kept identical. At the present time they were not; and this was owing in great measure to the unscientific construction of the Welsbach mantle. Of course, it was no use referring questions connected with science to the Welsbach people, as they knew all the sciences, past, present, and to come. But they had all noticed that there were no end of mantles which simply collapsed almost immediately. All the "starch" seemed to go out of them; and they were quite useless for giving light after that. The fabric of the mantle was not where it ought to be—not where it could become incandescent. Why was it that, when they used intensified gas, the more they intensified the heating power independently of pressure, the sooner the mantles collapsed? It was because the application of the intense heat to the earths of the mantle had the effect of contraction; and although this was brought prominently before the world at the time Wedgewood invented the pyrometer, it did not seem appreciated, and was not listened to by the makers of these mantles. He thought the Kern burner ought to have been brought more to the front, for it was by far a better burner than the "C." With regard to the question of introducing air into the two burners—to the "C" by means of the chimney, and to the Kern by means of the injector—he would make a slight emendation in Mr. Grafton's excellent paper. He should not apply the term induction to the two processes, because they were different. In the Kern burner, the air was really brought in by induction, because it was an injector; but he should rather favour the idea that it was a process of eduction with regard to the chimney. It might not seem very important; but as the two processes were different, and the result obtained by induction was perfect combustion, it would be well to make a distinction. But the failure of the Kern burner to satisfy the public must be taken into account. The hissing noise occasioned by the single-hole nipple, which had not been overcome, was one of the reasons why it was not favoured in drawing-rooms. People in such places liked themselves to make all the noise they wanted; and this was one of the causes of the breakdown. If they took out the single nipple, and put in a three, four, or five holed nipple in its place, they would obtain a very good result, without noise; but they would go back in the candle power. They had had before them that morning three papers which deserved very careful study on the part of all the members; and the Institute had reason to congratulate itself upon them.

Mr. J. H. Sheldrake (London) said Mr. Sugg's paper was interesting to a certain extent; but he gave no data to go upon with regard to the pressure increases; whereby he obtained 32-candle power in his burner. He should be glad to have some information how it was done. With regard to the lamp on the table, no doubt it was a most ingeniously worked-out idea; but he certainly looked at it with a good deal of fear when he considered what it might be, with regard to maintenance and looking after, if they had some hundreds of them in the streets. There were springs, diaphragms, and valves, which were always liable to get out of order; and his idea was they should get something as simple as possible. If they could have a burner where there was no mechanism required—where the high power was obtained solely by the burner and its chimney, this would commend itself to everyone. Mr. Grafton's paper was very interesting to them all, and furnished material for much thought and future developments. With regard to the Kern burner, he was wondering whether the same nipple or gas-jet was used in all the experiments, because it was well known that, to get the best efficiency from the Kern burners, the nipples had to vary according to the pressure and quality of the gas, and it was very possible that, if the nipples had been exchanged, higher results would have been obtained. His experience was that the Kern burners gave much better results than were shown in the tables.

Mr. W. H. Y. Webber (London) considered they had really had four interesting papers that morning; for Mr. Shadbolt's valuable statement might fairly be elevated to the same rank as the other papers. With reference to Mr. Sugg's communication, he should like to remark that he was afraid, in the course of it, the author rather magnified the influence of the burner, and said less than he might have done about the composition of the mantle. He said, referring to the Clamond light at the Crystal Palace, that with the new burners of to-day we should get a great deal more than 150 candles for that consumption; but he (Mr. Webber) thought the word "burners" there must be a misprint for "mantles." They had discovered the fact that the burner had a great deal to do with the result; and they were finding out by degrees what could be done in the matter of burners. But they must not forget that the starting-point was the application by Auer von Welsbach of the extraordinary phenomenon, which had never yet been accounted for, of the selective incandescence of the oxides of the rare earths. Of course, Welsbach did not discover that. They all knew how someone—he forgot for the moment who it was—accidentally sopped up some solution of the rare earths with a piece of blotting-paper, which he burnt afterwards, when he was amazed to see the extraordinary brilliancy of the sparkles which ran along the tinder of the burnt paper. That was the starting-point of the incandescent gas-lighting system. With regard to the Scott-Snell lamp, it was one of those things one could not criticize, except in the light of results. It was not much good saying a thing would not work because it had this, that, and the other delicate part attached to it. The same might be said of a watch. There was a very fine hair-spring, and this, that, and the other part as delicate; but still, as a matter of fact, watches did go fairly well. His own attitude with regard to these things was that they could not criticize them upon any *à priori* presumption. If they answered, well and good; but further than that he did not feel inclined to go. Mr. Grafton's paper rather touched himself, because the writer had repeatedly alluded to a creature of his own; he had been speaking of "low-grade gas." When he (Mr. Webber) used that phrase first, Mr. George Livesey objected to it, and said it had a somewhat depreciatory sound. Then he suggested it might be called "light gas," as distinguished from heavy carburetted gas. Mr. Livesey rather liked that term; and so usually he (Mr. Webber) had called it light gas—meaning the bulky gas made from the highest possible carbonization of the coal, cracked up to the *n*-th degree by the greatest amount of heat that could be brought to bear upon it, so as to get the most gas possible per ton. He had explained in his lecture last year that there was now sold in Germany gas with an illuminating power of about 10 candles. This he called light gas, or low-grade gas; but it did not contain any air, and he objected strongly to any such confusion of thought as would be necessarily introduced here by the author unless he protested against it. He objected to Mr. Grafton ploughing with his heifer under another name. He should call Mr. Grafton's mixture, "adulterated gas." Whether the particular incandescent lighting system here advocated would have the addition of the air made at the point of consumption, at the service-pipe on the right side of the meter, or on the wrong side of the meter, was a point on which a gas manager and consumer would probably entertain some difference of opinion. When they came to talk of adding from 10 up to 30 per cent. of air, irrespective of which side of the meter it was done, it was, to say the least, putting an additional complication, into the solution of the problem of incandescent lighting, which was not likely to be of real service. He objected entirely to any such suggestion as that. It was a move in the wrong direction altogether. He thought Mr. Grafton had been a little misled in his laboratory researches. Referring to

Table I., at letter D, he started with coal gas of 15·65 candles at a pressure of 1½ inches, and obtained 76 candles light. Then he mixed air with it, and got it down to 12·92 candles; and at the same pressure (1½ inches), he only obtained 45-candle power. There might be some improvement there; but he could not see it. He should have thought from 76 to 45 candles was rather a fall. He certainly thought the consumer would object to paying for the change. But when he came on to the 4-inch pressure, the coal gas only showed 65 candles; whereas the adulterated stuff went up to 116 candles. This, however, was entirely a matter of the working of the burner. If it was the same burner, it simply meant that the burner at 4 inches pressure worked better with a little more air put in than the pure gas did. They must not forget that Mr. Frank Livesey proved years ago that a great deal of the efficiency of incandescent lighting depended on the proper commixture of air with the gas. Seven or eight years ago, he—by simply mixing air and gas in proper proportions in the gasholder, closing up the holes at the bottom of an ordinary Welsbach burner, and sending the ready-made mixture through the burner—obtained a better effect than any incandescent burner then gave. As Mr. Shadbolt said, it was all in this—the only question was the way in which it was done. It could not be said that Mr. Grafton's plan was the proper way to do it in business—that the consumer was to keep a pump on the premises to force air in. All these various forms of incandescent burners were simply dodges for mixing the air as thoroughly as possible, and getting the flame to fill the mantle. What was more, the principle of the Kern burner (as Mr. Canning said) was to get the mantle, if possible, into the zone of most intense combustion. Kern's patent said so; and they could not get beyond it. It could not always be done, if the mantle went a little on one side, or was not of the right size; but it was the simplest principle in the world. There was in the bunsen burner a point at which the mixture of gas and air was burning at the very highest temperature—a point just beyond the inner blue cone in an ordinary blow-pipe flame; and if one could put the mantle there, that was where the best result would be obtained. He certainly thought these papers and the discussions would do some good; they would bring the matter more to a point. Everything which tended to make them understand a little better what was the source of the luminosity of the incandescent flame, would, of course, lead to a proper appreciation of every real improvement that came out; and there was plenty of room still.

Mr. Charles Wood (Bradford) said he had listened to these papers with very great interest, especially to that of Mr. Grafton, though he scarcely thought the title was borne out by the paper; nor had he any idea it would take that form, or he would have brought with him the results of some experiments he had had tried on somewhat similar lines. The conclusion he came to (which was confirmed by what Mr. Webber had said) was that the result to be obtained by mixing gas and air separately before coming to the burner, was simply a matter of complete admixture and perfect combustion. If, by any previous mixture, one could get a better result in a particular burner with a particular jet, either that burner or that jet was not the one best suited to the gas that was being used. He had had results as high as 40 candles per cubic foot with a particular mantle by mixing gas and air; but he had equally good results by altering the burner or the nipple. He could not help thinking that, if Mr. Grafton would continue his experiments a little further, he would find that, by improving the burner for the particular gas he was using, he would obtain very much better results than he had with the conditions under which he had worked. He scarcely thought he had used in every case a jet properly proportioned to the quality of the mixture of gas and air and the rate at which he was burning it. While such experiments were very useful to show the maximum efficiency which could be secured under certain conditions, he thought such a proposal as supplying a mixture of gas and air in any form was quite out of the range of practical politics, and need not be seriously discussed. Mr. Grafton said there was no need, under his system, to maintain the parliamentary standard of illuminating power above 10 candles, but he thought that every gentleman in the room felt the need of maintaining it. It would be simply impossible to attempt to induce Parliament to allow them to supply 10-candle gas, especially if it were brought down to that point by the admixture of air. The Scott-Snell lamp was, in his opinion, a most wonderful lamp. They had had one of the earliest patterns in use for nearly six months; and although they had had little difficulties, some of which had been pointed out in the paper—such as the valves sticking, due to grease or something of that sort, and trouble with the earlier type of reverter, which was a mercury one—he believed these obstacles were now to a great extent removed. For the purpose of intensified gas lighting, he thought this system had a future. But while intensified gas lighting might have a field in special cases, for every intensified lamp any of them were likely to use, they would probably want several hundred ordinary lamps. They might do for large open spaces; but for ordinary streets it was much better to have a burner giving as much light as possible at the ordinary working pressure, like the Kern burner.

Mr. Robert Watson (Hertford) said that the last speaker touched upon a point which had been in his mind for some months. They were likely at Hertford in a few weeks to be in competition with the electric light; and during the last few months they had been endeavouring to find out which of the incandescent burners would be most efficient for street lighting. He had been, in a humble way, making some experiments. They were not of the scientific nature to which Mr. Sugg alluded, because small works like his could not afford an elaborate apparatus, such as a portable photometer. The method he adopted was a very simple one. He used the ordinary type of a newspaper, and judged by the effect of several burners of each system in reading the type at a certain number of yards from each lamp. He found, taking a No. 2 Kern burner, as the average of some half-dozen tests, that he just lost sight of the type at 17 yards. With a No. 4 Kern, this distance increased to 32 yards; and with a high-pressure incandescent burner which he had in his own works for lighting a certain space, giving nominally 300-candle power, he just lost sight of the type at 48 or 50 yards. When one endeavoured to check these figures by the amount of light each burner would give at a distance by working it out in the ordinary way—the efficiency of light depending inversely on the square of the distance—he got these figures: The 300-candle power high-pressure lamp at 100 yards would give a candle efficiency of about $\frac{3}{100}$ candle. On the same basis, a No. 4 Kern at 58 yards would give the same amount of light; and a No. 2 Kern at 42 yards would give a similar illumination. Taking his own crude test, and multiplying, to bring it on to the same lines, he got 100, 64, and 34, as against 100, 58, and 42, which was sufficiently close to show there was not much error. His purpose, however, was to find out which was the best burner for lighting narrow streets—not open spaces, such as one saw in large towns, or a parade at the seaside. If they took any street (say) half-a-mile or 800 yards long, it would require, on the basis given, some eight burners of 300-candle power, consuming (say) 80 cubic feet per hour. With No. 4 Kern burners, it would require fourteen to get the same efficiency, consuming 56 cubic feet per hour; and with No. 2 Kern burners, it would need nineteen, with a consumption of about 43 cubic feet per hour. So that, from the point of view of illumination of small and narrow streets, the smaller unit of light appeared to be the most efficacious. Taking into consideration open spaces at street corners, the number of square yards illuminated seemed to bear some relation to, and to increase fairly equally with, the number of candles given nominally by each kind of burner. He should like to know, from any gentleman who had made experiments of this kind, which he considered the best unit of light to use. It seemed to him that, with the largest unit, such as 300 candles with high pressure, they had tremendous intensity at one place, which diminished at 100 yards to a mere fraction of a candle. It was a sort of crescendo and diminuendo effect along the street. With the smaller units placed closer together—although it might increase the capital cost—the consumption of gas, with a more even efficiency of light, decreased, and greater satisfaction was given to the general public. He thought that if they had high-power lamps running along the streets, they would have complaints from inhabitants of illuminating their bedrooms unduly, and preventing sleep. It seemed to him that a No. 4 or No. 3 Kern was generally the most efficient. Although the No. 2 Kern was, on the average, fairly efficient, still, if the mantle became at all deteriorated, the loss of light was more likely to be noticed than the loss from the mantle of a No. 4 burner.

Mr. W. W. Hutchinson (Barnsley) asked how Mr. Grafton got over the difficulty with regard to the colour of the light in making the comparison with the 10-candle pentane photometer.

Alderman Miles (Bolton) said they all admired the gentlemen who had been experimenting so largely in the past, and hoped they would go on and prosper, and bring their inventions to a successful issue, with respect both to the forms of the lamps and getting the full value of the lighting properties of the gas. But there was one thing which touched him more closely than all these. Could any gentleman tell them when they were likely, or whether they were likely in anything like a reasonable time, to get mantles which would really live and be of some commercial value as regards their adaptability to be handled by ordinary people. He had seen some scores and hundreds of people who had discontinued the use of incandescent gas lighting simply because the mantles were so fragile that consumers would not be bothered with them, and would not go to the expense of constant renewals. He was very anxious to hear from any of the members of the Institute whether anything was being done in this direction; and, if so, what were the probabilities, in the near future, of gas authorities being in possession of a really sound, serviceable mantle, that would stand the usage of an unskilled consumer of gas?

Mr. C. E. Jones (Leyton) said he did not intend to discuss the various qualifications of these burners, which had been threshed out with more or less success; but there was one point with regard to the incandescent mantle which might be borne in mind—namely, that to get the best result, the gas and air, must be thoroughly diffused, or the maximum available temperature would not be attained. Some years back, he was engaged with several other scientists in making a series of experiments with regard to the cause of explosions in mines, in connection with coal dust; and in order to get the maximum amount of explosion—which was the most perfect combustion—it was found necessary to allow the gas and air to remain in contact for fifteen or twenty minutes for each cubic foot. Simply mixing it and running it through at a high velocity had not the same effect as when thoroughly diffused in a vessel. He threw that out for the benefit of those who were inventing burners; and, if desired, he would hand over to the Secretary the results of his experiments. The point he wished to call attention to particularly was not that of the burner, but it was on the question of a mechanical auxiliary for increasing the pressure. He had no doubt that what he was about to say would be considered a damnable heresy, but he disagreed entirely with the principles and practice of supplying the enlightened British public with gas at low pressure. He was convinced that the low-pressure theory would have to be given up, and that they would have to supply gas, from the trunk mains at any rate, and perhaps at the services and at the burners also, at a greater pressure than was now usual. The waste of capital in laying down large mains was very serious. It hampered the undertaking, it retarded the reduction in price, and it encouraged rival illuminants; while the consumer was burdened financially. If they could drive as much gas through small mains by increasing the pressure as they could through large ones at a low pressure, it would save the capital account; and he believed this would have to be done. What was the pressure now? It was a compliment to call it a "pressure." It was only a few ounces on the inch. Then they were met with the contention that, if the pressure were increased, there was exosmoic action going on, and that they would lose light gases. But this was only thrashing a dead horse. If they laid the mains sound and deep enough, in a zone of equable temperature, and coated them and kept them away from surface vibration and frost, they would get none of this action but what was infinitesimal. Of course, the meter makers might object, and say they would have to alter their meters; but they were quite competent to do so. There were many advantages in driving gas through pipes at a high pressure, which he need not take up time by referring to. Complaints had already been made about there being too many pipes in the streets; and the local authorities grumbled. In the case of Mond gas, on which Mr. Webber had thrown so much light, it was said there were too many pipes in the streets; and it was pointed out that Mond gas would require a pipe four times the capacity of an ordinary gas-main. They said nothing about driving the gas through at a high pressure; but it occurred to him, in listening to some of the evidence, that there was a splendid opportunity for gasmen to make a new departure. The delivering capacity of the mains was doubled by the application of four times the pressure. It would follow that, if the Mond people used four times the ordinary pressure, they would not want their mains larger than the coal-gas mains. This would save capital. The existing mains would answer the purpose. No machine was wanted to intensify the gas. He did not favour the theory of intensifying the air; but he would intensify the gas by causing gas engineers to lay their mains in such workmanlike fashion as to bear any pressure required. The water-works men had to do it; and if anyone was at all timid about laying down gas-mains to stand the pressure needed, he would show him how to do it. They wanted a perfectly tight distributing system, capable of standing pressure; and then Mr. Sugg would not need his pressure increaser. All he would have to do would be to sit in his easy chair, and invent another burner which would meet the altered circumstances.

Mr. T. Bower (West Hartlepool) said he might give particulars with regard to a plant he had erected nearly two years ago. It was put up by Messrs. Sugg, and the pressure increaser used was exactly that shown on the diagram. The installation was fitted for the purpose of lighting a boiler-house, engine-house, and carburettor and generator house—in fact, a complete set of buildings for a carburetted water-gas plant. In addition to this, they had outside the premises two large lamps of the Lambeth type, for the purpose of lighting the yard. Inside they had two Westminster lamps and three Taj lamps, and also some small burners with anti-vibrators just shielded by the ordinary form of globe. After some little difficulty in getting the installation started, it worked fairly satisfactorily, especially in the boiler-house, engine-house, and the upstairs floor of the generator-house. But so far they had had no end of difficulty in getting the outside lamps to work properly. While they had secured a most excellent light with the minimum number of mantles inside, they had, to get anything like a good result outside, to be constantly renewing mantles; and, in fact, during part of last winter they had, in consequence of the great trouble and expense, abandoned the outside lighting. Probably they were at fault; but he should like Mr. Sugg, if he could, to give some idea as to what was likely to be the cause of their getting such excellent results inside from the same system which outside had been an absolute failure.

Mr. Vincent Hughes (Smethwick) said Mr. Grafton had stated that blue gas or water gas proper was of no use for incandescent lighting, when employed with existing burners. Did he wish them to understand that there were no burners obtainable suitable for incandescent lighting with blue gas? He had quite recently got hold of some made on the Continent which burnt blue gas at the rate of about 10 cubic feet per hour with most successful results.

Mr. J. Lyne (Wexford) referred to the statement in Mr. Sugg's paper, that "the quantity of air supplied into the interior of the mantle with the gas is not sufficient to produce perfect combustion; but the mixed gas and air burning under the mantle exercises a very powerful attraction on the oxygen of the surrounding atmosphere, and causes it to part company with the nitrogen." He said he thought Mr. Sugg would have a little difficulty in proving this assertion. If his memory were right, he believed oxygen was of a higher specific gravity than nitrogen; and he did not see how a little more pressure would draw it away from such an intimate mixture as the atmosphere was composed of, "and cause it to part company with the nitrogen." It was to the words "part company" that he specially objected as an explanation of the increased illuminating effect produced by high-pressure incandescent lighting. In all cases where air was used as the supporter of combustion, the nitrogen went on to the very point of combustion; and there was no parting of company till the union of the oxygen with the combustible matter had taken place. Otherwise, they would have very different results, not in lighting only. He regretted feeling impelled to protest against this explanation of Mr. Sugg's, for he was well aware of the good services Mr. Sugg had rendered to the interests of the gas industry.

The President said the members were much indebted to these gentlemen for bringing forward their papers on a subject which was just now exercising the minds of all gas

engineers. He had not as yet been able to obtain one of the Scott-Snell lamps, but he had seen them burning, and the light no doubt was a very excellent one. Mr. Sugg's lights also were very fine; and all those who had been to the Paris Exhibition and other places where the grounds were lit by the high-pressure system must see at once that the lighting effect was simply marvellous. The electric arc lights were quite glimmers compared to it. The trouble to his mind in applying this system of lighting to the public lamps was that they had to provide some motive power; and as long as this was so, he feared the light would not have much progress. The result of inquiries would go somewhat in support of the mixture of air and gas in the burner itself; so that they might not have to employ extra men to look after the lamps. It would probably be discovered that they would arrive at the same result in an easier way. At all events the papers, in his opinion, would well repay study; and that was really their great value—not especially on the day they were read, but in careful examination afterwards.

Mr. SUGG, in replying to the discussion, said he should only refer to the criticisms on his own paper, and leave Mr. Grafton to deal with the others. He must say that Mr. Shadbolt had given him a great deal of interesting information. He had been working in a contrary direction to himself; but he (Mr. Sugg) had always tried to see, first of all, what the result would be of using low-pressure burners beginning at 1 inch, and gradually working up to 12 inches, which was the highest pressure he had successfully used up to the present at the outlet of pressure-increasers. The principal pressure used was 10 inches, which was enough to put the governors at the foot of each burner in action, and give 9 inches underneath the inlet of the burner. This was enough to produce the velocity he spoke of through the jet, and thus bring in a sufficient quantity of air to furnish the brilliant light seen in the burner. Very deferentially he would say that he did not like to hear gas engineers speaking of intensifying gas-light. Their object was, not to intensify their light, but to bring it out in volume, and not the same as the electric light people did. This intensifying was a defect in the electric light which electric engineers might be very glad to get rid of. Gas engineers strove, on the contrary, to increase the volume of their light; and this was what they had done, although they spoke about intensifying gas-light. The electric light was an intense light, but a light of comparatively little volume or diffusive power. Gas-light, on the contrary, was a light of great volume with comparatively low intensity. Perhaps, some would be of a different opinion; but it was clearly a question of volume of light rather than of intensity. Some seemed to think his theory about the combustion of gas within the mantle was wrong. Professor Lewes said he was slightly wrong; but it was Professor Lewes to whom he was indebted for the idea as to what it was which produced the light given by the combustion of gas in the ordinary burner. He said, first of all, the gas coming out of the burner was roasted in the blue part of the flame, and produced acetylene; and this acetylene, combining with the oxygen of the atmosphere above the blue part of the flame, produced the light given by the ordinary fishtail burner. He took this to be correct. The same thing came about with regard to the present lighting by incandescent burners and mantles. The gas passed up into the mantle with a quantity of air, not enough for its proper combustion, but sufficient to "roast" the gas; and then the mixed gas and air, being heated up to a certain point, produced acetylene gas. The oxygen of the atmosphere was violently attracted to the acetylene in the interior of the mantle, and, separating from the nitrogen, diffused itself into the acetylene through the meshes of the mantle—much the same as the oxygen combined with hydrogen on the ball of lime in the lime-light, producing a beautiful white and brilliant light. This was more especially the case with high-pressure lighting; the result in illuminating power being about double the volume, with greater brilliancy than with low-pressure lighting. It was noticeable that naphthalene, when burnt at a comparatively high pressure in a flat-flame burner, appeared to have a like attraction for the oxygen of the atmosphere. The oxygen of the atmosphere was drawn away from the nitrogen exactly the same as in the case of the limelight, where they saw the effect of the oxygen rushing to the hydrogen and impinging on the lime-ball with a slight explosion. These high-pressure burners did exactly the same thing. There was, therefore, a reasonable ground for his theory. Professor Lewes said it was not quite right; but, if it was not, perhaps ninety-nine parts were right, and the other part was not. He preferred not to go further into the question of acetylene; and he would merely put it in this way—that the mixed gases had the property of abstracting oxygen from the atmosphere. The nitrogen in the inside of the mantle went up through the hole at the top. If they stopped the hole at the top, they would soon find the mantle would break, owing to the heated nitrogen forcing its way through it. When they did not get quite enough air into the burner, they could see a kind of bluish haze going out at the top of the mantle, which showed that some of the gas, not properly consumed, was passing away with the nitrogen. When there was a proper mixture, and a proper mantle, they saw nothing of this kind; it was all radiant light. The interesting part to him of Mr. Shadbolt's criticism was that he, instead of driving a jet of gas to suck in the air, had been using a jet of air to suck in gas from the outside. He did not know whether this was the best plan. It might be; but Mr. Shadbolt said it amounted to pretty well the same thing. It was worth trying; and he thanked Mr. Shadbolt very much for the idea. With regard generally to his view of the mixing of air and gas, he (Mr. Sugg) had always endeavoured to let the air mix with the gas at the top of the burner. It was a curious thing, by the way, that 9 inches of pressure under the jet at the foot of the burners would secure what they had been trying to do for a long time for the purpose of experiment—viz., a sensitive flame. With this high-pressure jet, they had a sensitive flame, so that they had only to rattle a bunch of keys in the pocket, and it shrank down to half its height. As to the question of the pressure in the mantle, there was no pressure. They must have velocity, but no pressure, or only just about enough to keep the mantle in shape. He thought that was the best plan—to put the high-pressure gas into the burner. The mantle would then last longer than with low-pressure gas, because the substance of which it was composed, instead of crumbling away by the heat, was fused together by the higher heat; and this made it last longer. A question was raised by Mr. Miles about double mantles. They all knew that the manufacture of mantles was a very difficult operation; but there had lately been a great improvement in high-pressure ones, and when well made they would last a very much longer time than formerly. But the burners must be suited to the mantle, and to the quality of the gas. The making of mantles was too delicate a point for him to touch upon on this occasion; but no doubt there would be improvements, and they would last much longer than they did now. The main thing was that a certain amount of care was required in their use; but when one obtained such a tremendous result from a small quantity of gas, it was worth while to take a little trouble. No doubt there would be a lot of people who would always revert to a hole in a gas-pipe. They might have the best and most scientific burners; but some would prefer the hole in a gas-pipe, because they could get light of some kind there easily. This had been the story ever since the introduction of gas. Every gas engineer liked to be able to get the result he wanted without apparatus (and they had been rather spoilt in that respect), and without any more trouble than just the turning on of the gas and lighting it. The idea of anything like machinery was rather repugnant to their feelings; but when they went into the facts, and saw how little it cost to raise the pressure by water or steam, they would see it was well worth doing. In the lighting they had in that neighbourhood, the cost was only 1d. per 1000 cubic feet—and not so much lately, because the price of water had been lowered. It used to be 1s. per 1000 gallons, and now it was only 6d. This was in Whitehall and the Strand, where it would not cost more than about ½d. per 1000 cubic feet to raise the pressure to 10 inches. Where it was not possible to do this, they would have to use low-pressure gas, perhaps, as Mr. Shadbolt had shown. There was, he saw, a burner on the table which increased the supply of air by means of a long chimney. One could, of course, get air in either by suction or by pressure. His idea was that pressure was the best, and produced the most satisfactory result. One gentleman had asked for a description of the burner; but he thought it was not advisable at that meeting for him to say anything about the burner at all. He had simply put before them some useful facts showing

the effect of high and low pressure in the working of gas-burners, and the difference between that and the London argand burner, which had a very low pressure and almost no velocity. The strange thing to him was that, in order to get a good light, one had to increase the velocity enormously—the very thing that he should have said some time ago, would have had the effect of destroying the illuminating power. It seemed to be a question which had not yet been solved; but it was one of the most important points in the development of the illuminating power of gas by the incandescent system. In reply to Mr. Bower, he thought probably inside his buildings the lamps were better protected, and more free from vibration. Probably, inside the house they were suspended.

Mr. BOWER remarked that they were bracket-lamps in each case.

Mr. SUGG said there was often a good deal of vibration in bracket-lamps; but he had no doubt he could supply Mr. Bower with an anti-vibrator which would be effective to overcome the difficulty. The vibration in Whitehall and the Strand was very great; but, with a suitable anti-vibrator, the mantles were protected from the shocks caused by the passing of heavy vehicles.

Mr. PHILLIPS, after apologizing for the absence of Mr. Scott-Snell, who was on his way to America, said his only idea in this lamp was to obtain the greatest possible volume of light from a single unit, without using any auxiliary apparatus or power other than he could obtain by the waste heat from the gas itself. Mr. Shadbolt spoke of a lamp he had had for about three months, which had given some little difficulty at starting; and he also referred to the question of the spoiling of mantles. He was not sure what life they had; but, as a rule, Mr. Scott-Snell found the mantles lasted from six weeks to two months. At the present time, there was at the Great-Western Railway Station at Paddington a lamp which had been fixed for about three months. The last mantle was fitted on May 2, and was in excellent condition now. The starting trouble had been dealt with by substituting balloon silk for leather in the diaphragm. This had been found to act in most instances (notably at the Glasgow Exhibition, where Mr. Foulis told them that he was thoroughly satisfied with the operation of the lamps). Mr. Sheldrake criticized the amount of mechanism, and, of course, one could understand his attitude; but Mr. Webber surely answered that very well when he said that these things should be judged in the light of results. Mr. Scott-Snell would only be too pleased that his lamp should be judged by that test. Mr. Wood said he had a lamp in use in Bradford for six months, and considered it a wonderful lamp. He did not think there were any other criticisms on the paper he need refer to; but he might be allowed to mention one point—the use of air—which was dealt with by Mr. Grafton. Mr. Scott-Snell in his paper referred to the fact that, under certain conditions, he had obtained 40 candles per cubic foot from gas, or probably would obtain quite that. He had a device for bringing air into his apparatus before it was used at the burner. It was still in a more or less experimental stage; but it was by using air in addition to gas, and in a different way to what was shown in the lamp, that he obtained the 40 candles. Alderman Miles asked if anyone had any information to give as to a more durable mantle. They had made some experiments with a mantle which was certainly more durable than any at present on the market, and had had two running on a lamp continuously for three months with four stops, which were due to the fact that the man looking after them wanted a rest. The mantles were in perfect condition. It was not a new mantle, but a special treatment of a mantle now in use, which would enable the user to take it off the prop, lay it on its side, and return it to the burner at will. In his endeavour to obtain a big unit, Mr. Scott-Snell had used a modified No. 7 Kern burner, with which he obtained 550-candle power from 15 cubic feet of gas.

Mr. GRAFTON, in reply to Mr. Shadbolt's question as to why he used the "C" burner and the No. 3 Kern in preference to all others, said that he took them because the "C" was the most popular burner and the one most in use. The No. 3 Kern his own experiments proved was the most efficient of the series now supplied by the Welsbach Company; and he chose this as the basis of the experiments, thinking, of course, that he could get comparable and reliable results. In fact, he had tried the "Gem" and other burners; and in all cases found a distinct improvement by adding air to the gas supplied to them. Some of the experiments referred to by Mr. Shadbolt were not comparable; and therefore his remarks as regarded the comparison of economy did not hold good. By Mr. Shadbolt's way of showing, the "C" burner and mantle was only 1 candle behind the No. 3 Kern and mantle. With regard to his (Mr. Shadbolt's) experiment of adding air to the burner instead of where he was doing it, he (Mr. Grafton) did that too; but it necessitated a large quantity of air being added, when he found it was not really necessary, as a small quantity added with the gas sufficed. He therefore allowed this method to stand on one side. Mr. Shadbolt also referred to a German invention doing pretty much the same thing, and that was so; but, if he might be permitted to correct him, it was a communication from the United States to a Patent Agent in England to take out a patent, and it would be found in the "JOURNAL OF GAS LIGHTING" for April 23 (p. 1068). He, however, might state that an application to a patent agent had been made prior to the publication of Brooke's patent; and also his experiments were completed before then. With regard to the efficiency of the "C" burner and Kern burner not being much more than could be obtained by ordinary lighting, he might say, first, that in using the "C" burner he took it as it was bought, and used it, and did not tamper with it in any shape or form. He took one "C" mantle, put it on the burner and burnt it off, and then used it on one burner. With the exception of Series G, the experiments were all made with the same mantle from beginning to end. It was not a series of mantles, but one mantle, taken from one burner and put on to another. This was one of the reasons why the results of the experiments were not quite comparable. He did not think at the time that it was necessary to be so careful to see that he had exactly the same unit surface of mantle in the two burners. His object was more to show that adding air at a place previous to the point of consumption was a great advantage. With regard to the quantity of air used—6 to 1 of gas—this was quite right. Mr. Sugg had taken the same thing, because in one part of his paper he gave 5 to 1, and farther on 7 to 1. The mean of these was 6 to 1, which gave about the most efficient result. With regard to the blowing away of the mantle, in that case it was not a "C" mantle, but a No. 1 Kern—a very small mantle comparatively. The two, of course, were very different in size; and naturally, to get the same quantity of gas through this unit surface, it had to go at a greater speed—not pressure as Mr. Sugg explained. He quite agreed with Mr. Canning as to concentration and intensity of heat. If they wanted to get the greatest intensity, cooling the gas ought to be avoided. The calorific value did not entirely regulate the results they were going to get; it was not the primary thing, after all. He had been asked why he did not make more experiments with the Kern burner. He had given two or three cases to show that at least there was a benefit found with that advanced burner, as well as with the "C" burner, by adding air prior to reaching the point of ignition. The hissing noise could be overcome absolutely; but at present he could not tell them how. In answer to Mr. Sheldrake, perfect incandescence, of course, was what they all tried to secure; but the easiest way to obtain it was simply by increasing the speed and reducing the pressure. This was why he adopted the words "low-pressure gas" instead of "high-pressure gas," which one gentleman interpreted his meaning to be. When they adopt the latter method, they must have a free outlet at the burner (as in the Kern), as compared with the limited outlet in the case of the "C" burner. As for adjustment of the nipples, it seemed to him a great waste of time to constantly take a burner off and adjust it, when the case might be met by adding a small quantity of air, so as to make the nipple suitable to any quality of gas. Certainly the public would not go to that trouble; and they ought to be considered first. The object to be aimed at was to know whether the public would adopt these things. They wanted something requiring very little attention, and which they could switch on and have done with. He was sorry if he had stolen Mr. Webber's phrase of "low-grade gas;" but it was a popular one to-day, and one he felt bound to accept rather than "light gas," because the interpretation they had heard that morning of light gas was not quite consistent when it was applied to Mond gas or to neat water gas. The two gases had different specific gravities; but they were not

distinctly light—one was heavier than the other. He therefore thought the term low-grade gas answered the purpose very well; but there was not much in this name.

Mr. WEBBER remarked that his point was that this was a mixture, not really a gas.

Mr. GRAFTON said it was all very well to talk about adulterating gas; but the public would scorn to have adulterated gas. They had quite enough adulteration in their milk; and that was why he avoided the word. Mr. Webber said the whole thing was a dodge from beginning to end; but the best results they could secure, after all, were purely dodges. His dodge was to blow air into the gas before it reached the point of ignition; and this would be found to be of some benefit. Mr. Webber also referred to the Series D experiments, under a pressure of 1½ inches. In that case there was certainly a loss so far as lighting power was concerned; but the reason was that he did not use an air-adjuster. If he had allowed half the proportion of air to enter by the ordinary intakes of the burner, the quality would have risen. He had simply given the experiments as they were made, without any adornment at all. Mr. Wood referred to the parliamentary standard; but he did not think, after all, that they should take so much notice of the parliamentary standard. They were apt to think too much of it and its evil effects; it certainly added to one's anxieties rather than one's comfort. In reply to Mr. Hutchinson, with respect to the standard he used and the colour of the flame, the difficulty was easily overcome by taking two strips of paper and placing one on either side of the disc-box—on the principle of the Harcourt table photometer—by which a shadow was thrown on the disc by one light, and the shadow in the opposite direction on the paper by the other. It was necessary to look at two shadows, not two illuminations. To an experienced eye, it was not difficult to judge accurately without this measure being taken. With regard to the use of blue gas, he was quite aware that blue or straight water gas would give an illuminating power with an incandescent mantle, provided one cut the air off at the bottom of the burner. If the air was allowed to enter, there would be no result other than he had given.

In our report of Mr. Henry Green's remarks on Mr. Porter's paper last week, the extra cost of 21-candle oil gas, as compared with 18-candle coal gas, should have been given as ¾d. (not 3¼d.) per 1000 cubic feet. Mr. Green, it may be remembered, had no figures with him; but on his return to Preston he looked them up, and found the difference for two years averaged 1·05d. per 1000 cubic feet more for carburetted water gas than for the coal gas he made.

Moorland Waters.—Investigations have been conducted by Mr. W. Ackroyd on the above subject, and the results recorded in the "Proceedings of the Chemical Society." One object he had in view was to discover the origin of the common salt in the water of the Widdop reservoir in Yorkshire, about midway between the two seas, this water being continually removed and as continually replenished from a saltless area of millstone grit and Yoredale rocks. The chlorine in the winter rainfall more than accounts for it; and the conclusions arrived at are: (1) That the combined chlorine in the reservoir water is wholly derived from rain water; (2) that the quantity of chlorine in the reservoir, the capacity of which is 640½ million gallons, closely approximates to a yearly average of 1·188 parts per 100,000; and (3) that in winter the chlorine in the rainfall is in excess of the average for other seasons of the year.

Gas-Engine Handbook.—We have received from Messrs. Crosby Lockwood and Son a compact little manual of useful information on the subject of gas-engines, prepared for the designer and the engineer by Mr. E. W. Roberts. This gentleman is the author of a series of text-books on the gas-engine for the International Correspondence Schools; and it was while he was engaged in their preparation that he was forcibly impressed with the dearth of matter upon American practice in this kind of motive power. In the work under notice, he has endeavoured to give a sufficient number of rules and formulæ relating to gas-engine construction to enable any intelligent draughtsman to design a motor. There are 25 chapters, with an appendix containing some notes and dimensions relating to two-cycle engines. This is the second edition of the book, which is an extension of the original issue by the appendix referred to; and opportunity was taken during its preparation, to correct typographical and other errors which had inadvertently been previously overlooked. The American publishers are the Gas-Engine Publishing Company of Cincinatti.

ESSAYS AND REVIEWS.

A NEW VIEW OF THE HOUSING OF THE POOR, AND MUNICIPAL TRADING.

[First Article.]

IN the April number of the "Quarterly Review," there appears an able statement of the Housing Question, as it has come to be called for the sake of brevity, and at some risk, like most abbreviations, of misconstructions. The reviewer explains the proper meaning of the term. It arises from the fact that the provision of house accommodation for the poorer classes of the population in town and country forms an exception to the general rule of improvement of quality and cheapening of price which prevails in respect to all the other necessaries, and many of the luxuries, of English life. There is no Feeding or Clothing Question. These and other important branches of supply have been filled by the ordinary operation of economic exchange. Extreme theoretical Socialists apart, there is no sane person found to advocate the municipalization of the food and clothing supplies of the poorest. For the utterly helpless, the sick, and the destitute, the Poor Law provides; but normally the general supply of the chief necessaries of life is left to manage itself according to economic laws. Hitherto, in a somewhat laboured way, the supply of houses has been furnished in a similar manner; but now, it is alleged, the operation of free exchange has failed in this department, and hence there has arisen what is called a Housing Question. In other words, the house market has got out of joint. Those who could supply houses and house-room will not do so at the prices which the poorest can afford to pay; and as this provision of housing accommodation is a necessary, which cannot be foregone on account of the expense, like a luxury, the conclusion is pressed that the supply must be furnished on some other principle.

The reviewer discusses the history of shelter or house-room, regarded as a necessary of life, and somewhat superfluously inquires into the manner in which this requirement originated. It is more to the purpose to distinguish the case of those people who are "housed," from those who house themselves. The reviewer, for all his painstaking, deals insufficiently with the case of the "housed," which, if more thoroughly examined, might have given him a key to several of the mysteries of the problem as it now stands, and threatens to block the march of civilization. It is pretty obvious that originally everybody built himself a house where he wanted to live, and as best he could. The castle of the Norman baron who had to "occupy" a certain district, in the military sense, and turned his post into a "seat," arose from the operation of causes as natural as those that influenced his vassals to cluster their shanties under its walls. Whenever circumstances required any man or number of men to be permanently located in a place not wholly of their own choosing, it was equally natural that the necessary shelter should be made, or that some special inducement of the kind should be offered for the settlement, by the superior authority. This would be the beginning of "housing." The condition still survives, as the reviewer points out, in the case of farm labourers, who do not pay the full economic rent for their dwellings on the estates where they are employed. The transaction is, of course, a species of "truck." The labourer, instead of being paid all his wages in coin of the realm, receives so many shillings a week and a house at a nominal rent. The bargain is open to the objection that applies to all forms of truck—the absence of a secure standard of value. One man may receive housing worth 30s. for every pound he pays for it, whereas another may only get housing at the rate of 15s. in the pound.

But the agricultural labourer is not the only man who is thus "housed." Far from it; whole orders and classes of the community are similarly circumstanced. The reviewer overlooks this great fact of everyday life, both in town and country, and goes off at a tangent to discuss sanitation, which is another story altogether. Whether a man is housed, or houses himself, the community must equally look after its own sanitary condition. A care which begins in the most private apartments of every residence, and only ends when the sewage effluent is made fit to take its place in the cycle of cosmic operations, must have an intimate bearing upon the subject of the house, but has not the same connection with the question of housing the population. In towns, sanitation adds to the cost of houses, but does not determine the question whether any class of persons shall "live in," for business or other reasons, or shall have official residences provided for them, or be at liberty to suit themselves with residences as and where they can.

The line of development of our civilization being from the condition of status to that of contract, everything belonging to the former order of society tends to disappear in favour of the things appertaining to the latter. The requirement of "living in," and in a lesser degree that of occupying a dwelling on the employer's estate, are badges of servitude when they are not distinctly advantageous to the persons concerned. As such, modern sentiment, which is all for the utmost personal freedom and independence, is against them in principle. We have in these columns urged time and again the liberation of gas managers from the ancient requirement to occupy an official residence on the works,

whether they liked it or not. This appears to be the only safe rule to go upon in pronouncing judgment in such questions. If a man has to "live in," or occupy a particular dwelling, for his employer's pleasure—his own wishes not being considered—then it is a sacrifice of personal freedom which ought to be made up for in some way. The bargain is not in this case a purely economic one, as an example of supply and demand settled upon market terms. The employee's poverty, not his will, consents to subordinate his feelings to the requirements of his employment, where these have an element of irksomeness additional to the ordinary duties of the position. On the other hand, "he is well paid that is well satisfied," whatever the medium through which satisfaction is conveyed.

With all diffidence—for the subject is a thorny one—we venture to suggest that this natural and for many situations imperative principle of "housing" for a particular object may be enlarged to cover the case of modern communities faced with the Housing Question. Here, however, we are met at the outset with the difficulty of distinguishing where and when the real "question" exists. By the definition with which we started, there can be no Housing Question at all, unless and until the supply of house accommodation for all free units of the community, whatever their means, fails to flow from the operation of free exchange. Consequently, until the economic data have been thoroughly ascertained and appraised, who is to say that the operation of free exchange cannot go on, or that some of its normal incidents cannot be bent to produce a favourable result?

In embarking upon such an inquiry, it is possible to proceed only in one way—from the known to the unknown. There is a house market, where money can be fairly made by builders and landlords, and where occupiers themselves can acquire their own dwellings by the help of Building Societies. It is by no means a safe market; and even those speculators who are most successful in it do not clear more than a reasonable profit on the money they risk. The limits of the value of the properties which are dealt in in this market vary in different places. We are now considering London, and the most densely populated centres of population; and here the limit of value ranges from £60 to £25 a year rental. It is chiefly suburban property; and the returns are proverbially uncertain. The trade requires knowledge and caution on the part of those who engage in it. "Development of suburban property cannot be hurried, and houses can only be let and sold gradually. The demand for them is by no means unlimited." It should not require argument to prove that local authorities should only enter into this market, as competitors with supply agencies who are themselves ratepayers, with the greatest caution, and under exceptional inducements to positive action.

It would be rash to lay down the hard-and-fast rule that local authorities must never even contemplate the Housing Question, when it is a case of providing dwellings costing 10s. or 12s. per week to rent. The class of people who occupy such habitations are those who feel the pinch of straitened means as much as, if not more than, the very poor; and it is they who are most helpless in the grip of rapacious landlords. High rents are a cause of overcrowding; and the species of overcrowded house which is often the den of secret misery and vice is the apparently respectable building in a neighbourhood that has "seen better days." Still, the objections to the direct action of local authorities with a view to counteracting this familar evil are very great. Much must be left to the mental and moral advancement of the people themselves, and to the growth of an appreciation of the benefits of space and quietness in the home. The increase of athleticism, moreover, is likely to cure the old predilection of English people for packing closely in town houses and lodgings.

When the economics of the Housing Question are dragged into light, the most conspicuous item is the capital outlay, and the value of the property. In mentioning just now the possibility of bending to a favourable issue in this regard ordinary incidents of free exchange, we referred to the special advantage possessed by a local authority of anticipating the "unearned increment" on the value of building land by virtue of Part III. of the Act of 1890. The common law of property is a fine thing in a general way; but it must be confessed that it puts landlords in a very advantageous position when it happens to go their way. Of course, landlords have also to put up with the converse operation of the law known as the "undeserved decrement;" but that consideration does not help the people who are pinched by the rise in value of land where they want it cheap. It strikes one as ridiculous that where land has become too valuable for occupation for residential purposes, the local authority or a big railway company should be compelled to build industrial dwellings upon it which can only let at a dead loss. The alternative would seem to be, clearly, to pre-empt for this purpose land which is not at the moment too high priced for this use. The authority, or the company, who do this, and voluntarily abjure the unearned increment known as an improved ground rent, will certainly perform a good public service. Where a municipality deliberately elect to rehouse persons of the labouring class in dwellings erected upon town clearings which would command a higher return if appropriated to other uses, they may be regarded as acting in this way because the community has need of these persons in that particular place. The reviewer calls this kind of settlement, where the rents do not meet the charges, a quasi-eleemosynary arrangement. So indeed it is, regarded in one aspect; but if the community want these people to be there, it is equally possible to regard them as occupying an analogous position to that of the agricultural labourer, provided at less than cost price with a dwelling on the estate to which he is attached. How far this requirement of location is justified is another question, and a very large one, which must be relegated to another article.

STAINES RESERVOIRS SCHEME.

It is scarcely necessary to recall to the recollection of those of our readers who are interested in water supply, the circumstances under which the above-named scheme was initiated, as they have been duly recorded from time to time in our columns. It will doubtless be remembered that it comprises the construction of large storage reservoirs at Staines, with a distributing reservoir at Hampton, and the necessary conduits and auxiliary works, by which an additional 35 million gallons of water (or 45 million gallons on an emergency, with the sanction of the Local Government Board) may be furnished to London daily from the Thames. It is being carried out by a Joint Committee composed of representatives of the Grand Junction, New River, and West Middlesex Water Companies, who made a formal commencement with it on April 30, 1898, when the Chairman (Mr. E. Boulnois, M.P., the Chairman of the West Middlesex Company) cut the first turf. In the period which has since elapsed, such good progress has been made that the completion of this section of the scheme is well in sight. Evidence of this was afforded on Monday last week, when the members of the Committee, accompanied by a number of guests, paid their annual visit of inspection to the works. The party travelled by special train from Waterloo to Sunbury—slowing down as they passed the reservoir at Hampton, to allow of a good view being obtained of it. They found it, with its two gauge-houses, nearly finished. From this reservoir the West Middlesex and Grand Junction Companies will receive their supplies; the New River Company taking their portion of the water at a point about half-a-mile westward of the reservoir, where there will be an outlet, with a gauge-house, from the conduit into the new works about to be constructed by the Company. The engine-house for the supply of their district has already been commenced.

From Sunbury Station the party proceeded in carriages along the line of the aqueduct, which is practically completed for the whole of its length, to the intake from the Thames, about 300 yards above Bell Weir. The works here consist of a sluice-house, with water-tower containing the sluices; a gas-engine and pumps for the gas-plant; a set of hydraulic pumps, with an accumulator, for lifting the sluices by the hydraulic rams placed above them; and a pump for delivering water into the tank and for washing the screens. The engines will be driven by Dowson gas, which is made in an adjoining house, next to which a small gasholder has been fixed. Two cottages for the men in charge of the intake have been erected close by. The buildings are similar in style to houses built on the banks of the river; and they were generally commended by the visitors.

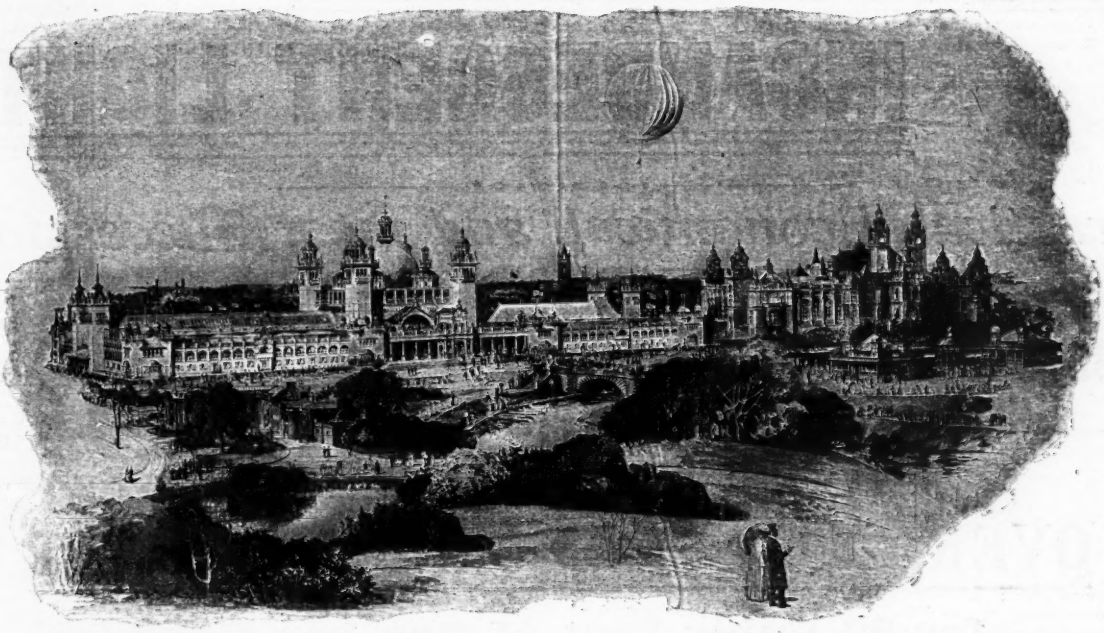
From the intake the party returned through Staines to the pumping-station, where there are five Worthington triple-expansion surface-condensing engines, each capable of pumping 16,000 million gallons daily into the storage reservoirs. The engine-house is 108 feet long, 55 feet wide, and 30 feet high. The boilers, which are of Babcock and Wilcox construction, are located in a commodious boiler-house, also containing one of Green's economizers, on the west side of the engine-house, to the north of which, and separated from it by a siding from the London and South-Western Railway, are the dynamo-house and the workshop. In the latter building, luncheon was provided by the Committee for their friends, under the presidency of Mr. Boulnois.

After luncheon, the party proceeded by train to the outlet works of the reservoirs, and round the reservoirs themselves—a journey of 4¾ miles. They lie north and south, cover an area of 421 acres, and will contain 3300 million gallons of water. Their embankments vary in height from 21 to 39 feet—the slopes being 3 to 1 inside and 2 to 1 outside. The width at the top is 14 feet; at the bottom, 224 feet. In the centre of each bank a puddle wall is constructed, 6 feet thick at the top, 7 feet at the ground level, and tapering down to 4 feet where it joins the London clay, into which it is securely toothed. This construction, for which this part of the Thames Valley is favourably adapted, will make the reservoirs perfectly water-tight. The inside slopes are faced with concrete 5 inches thick for a vertical depth of 15 feet, so as to resist any wave action which may take place in so large a sheet of water. In the northern reservoir, the slopes are concreted on three of the banks; and the whole work is in so advanced a state, that the larger of the two reservoirs will be completed within the present year, and the smaller one in the course of next year.

The works, which will cost upwards of £1,000,000, have been designed by, and are being carried out under the direction of, Messrs. Walter Hunter and R. E. Middleton, MM.Inst.C.E.; the Contractors being Messrs. John Aird and Sons. The engines are being constructed by Messrs. James Simpson and Co.; the steel mains, by Messrs. T. Piggott and Co.; and the gauges, recording apparatus, &c., by Mr. G. Kent.

Removal of the Gas Institute Offices.—We have been asked by the Secretary of the Gas Institute (Mr. Walter T. Dunn) to announce that the offices have been removed from No. 13 to No. 39, Victoria Street, Westminster, S.W.

Glasgow International Exhibition
1901.



FLETCHER, RUSSELL, & COMPANY, LTD.,

INVITE YOUR INSPECTION OF THEIR EXHIBITS AT

STAND 906.

HEATING AND LIGHTING SECTION (ANNEXE).

Gas Cookers.
Gas Fires.
Heating Stoves.
Grillers.
Water Heaters.
Tailor's Stove.
Blowpipes.
Muffle Furnaces.
Crucible Furnaces.
Gas Governors, &c., &c.

Mantels.
Overmantels.
Registers.
Interiors.
Kitchen Ranges.
Curb Fenders.
Restaurant Tables.
Theatre Chairs.
Park Seats.
Gates.
Railings, &c., &c.

WARRINGTON, MANCHESTER, AND LONDON.

Show-Rooms { 134, QUEEN VICTORIA STREET, LONDON, E.C.;
130, DEANSGATE, MANCHESTER.

WILLIAM SUGG'S
PATENT
HIGH-PRESSURE GAS
INCANDESCENT LIGHT.

Practical, Economical, and most Successful.

Every Gas Engineer should see

SUGG'S IMPROVED PATENT PRESSURE INCREASER AND HIGH-PRESSURE GAS INCANDESCENT BURNERS.

Marvellous Illuminating Effect.

OVER 1000-CANDLE POWER

for 30 Cubic Feet of Gas per Hour.

SUNLIGHT MANTLES ARE RECOMMENDED FOR THESE BURNERS.

Installations can be seen in London at—

Parliament Street;
Wellington Street, Strand;
The Strand Improvement;
Southwark Bridge;
Vauxhall Bridge Rd., Victoria Station;
Deptford Cattle Market;
Woolwich (outside Arsenal Gates), &c., &c.

MORE THAN 50 INSTALLATIONS ALREADY CARRIED OUT OR IN HAND.

This is the only System of Lighting which can compete with the Electric Arc Lamp; and this it does at **Half the Cost.**

SUITABLE FOR STREETS, RAILWAY STATIONS, DOCKS, WORKSHOPS, HALLS, &c.

WILLIAM SUGG & CO., Ltd., Engineers, Westminster.

ELECTRIC LIGHTING MEMORANDA.

Wholesale Electric Power Generation on Tyneside—Not a Transmission-in-Bulk Enterprise—Gas Companies as Suppliers of Electricity—Lord Kelvin on the Economics of the System on Tyneside.

THE inauguration of the first generating station of the new order, for the supply of electric power in bulk, is an event of sufficient importance to be specially marked in these columns. The episode does not lose interest from the circumstance of a Gas Company—the Walker and Wallsend Union Company—being largely responsible for the undertaking. The station in question belongs jointly to the Newcastle-on-Tyne Electric Supply Company and the Gas Company, who have for some time carried on the business of electricity supply in the neighbourhood. The new establishment is consequently more of an extension and a development than a fresh venture, which fact is an additional guarantee of the soundness of the scheme embodied in this novel form. The station is situated on the River Tyne, at Neptune Banks, and is designed to supply electric power, generated on the three-phase system, to a number of large engineering works and shipbuilding yards in the vicinity. Thus there is no "wild cat" about this particular venture. The business is actually on the spot, waiting to be done; and it will be done in a manner calculated to be acceptable to the local demand. This is a very different thing from putting an electricity-in-bulk generation station "in the air," or merely in some desert place where the source of power, whether fuel or water, happens to be cheap and handy. It is an instance of bringing the power to the place where it is wanted; not at all of making the electricity first, where it is not possible to use it, and then either waiting for applications to come to it or carrying it a long distance to where work is going on.

The difference is of vital importance. Electric power is doubtless convenient, and where it is to be had cheap it is still more advantageous. But, on the other hand, the power, electric or other, used in most manufactures is too insignificant an item in the whole working expenses to determine the location of any ordinary industrial establishment. Given a number of such establishments, already situated on contiguous sites, actually contemplating the conversion of their tools to electric driving—the question whether they shall generate their own electricity for this purpose, and also for lighting, or buy it wholesale from a supply company established practically by themselves and friends, is a pure business one. However the decision may turn in individual instances, the arrangement whereby such a business is to be done may be properly described as electric power supply by wholesale, but not of electric power "transmission in bulk." It is strictly analogous to the arrangement whereby several London electric lighting stations, finding local extensions impossible, club together and build a suburban works to supply them with their extra current. The gist of the electric position on Tyneside was clearly expressed by Sir Andrew Noble, who said, at the luncheon on the opening day, that the local "manufacturers should seriously consider what this Company could do, before ordering further plant or machinery." That is the whole point. The new undertaking stakes its prospects upon the belief of its founders that the answer of individual manufacturers to the offer will be sufficiently favourable to justify the venture.

It is an absurd calumny, originating with touting electricians and their journalistic allies and backers of the baser sort, that the partisans of the gas industry have any enmity towards honest trafficking in electricity, reposing on so sound and reasonable a trade basis as this. The best proof of our observation is the participation in the Tyneside venture of a Statutory Gas Company. Is it too much to hope that, after this striking evidence to the contrary, electricians writing and speaking in public will cease to accuse gas companies and gas departments of corporations of conspiring to prevent by unfair means the development of electricity supply? The same persons often talk of the superior expansion of electricity supply in America, probably without knowing that there the bulk of the business in electricity supply for lighting and traction purposes is done by the gas companies. Although their position is unique in this country, the Walker and Wallsend Gas Company are in line with the great gas interests of the United States. What British gas engineers do object to on the part of some electricians, and will never cease exposing and protesting against, is the bad habit of carrying on the electrical propaganda under false pretences. This originally took the form of claiming that electric lights were brighter and cheaper than they really are; and it has now developed into the systematic falsification of accounts by some municipal electric lighting committees. With such practices, we can have no agreement.

To return to the details of the Tyneside experiment. It is, as has already been stated, a fine example of a three-phase power station. The question of electricity generation at the pit head, and transmission in bulk to a long distance, is not involved, because the station is connected like any other works with the North-Eastern Railway by a siding over which the coal supply will come. Wherever this coal comes from, near or far, it has evidently been considered in the circumstances the best vehicle for the transmission of the potentiality of power generation. Lord Kelvin, who formally opened the new works, succinctly described the nature of the operations as consisting in the generation by steam units of 1500-horse power of three-phase current, for distribution to customers taking from 200 to 500 horse power, who will utilize it by "that most admirable motor, the three-phase motor" for power; or, after passing through a transformer, it will be used as continuous current at 480 volts on the three-wire system for lighting and power. The primary conductors will be under a pressure of 5500 volts, which was found to be the most economical of copper and insulation for the district. The alternative supply is offered for various reasons, one of which is that the three-phase motor does not yet run equally well at all rates of speed. Still, there cannot be much amiss with it, seeing that the Northumberland Shipbuilding Company use no other. A valuable account of the works appears in the current number of the "Electrician." The distribution from the sub-stations where the voltage is reduced, appears to be by overhead wires on poles. This may suit the district; but it would not be tolerated in many places. As Lord Kelvin remarked, the presumption is that in works where much electric power is required, it would pay better to generate it privately on the spot, instead of buying it from an outside source. He declared that this is not so—hence the existence of the new venture. Time will show where the advantage lies.

THE GAS AND WATER STOCK MARKET.

BUSINESS on the Stock Exchange last week was almost as limited as it well could be. The attractions of Ascot and one thing or another exercised such a powerful influence to draw people away that the attendance throughout the week was reduced to very small numbers. Coupled with this, came a depressed tendency; so that, from natural heaviness and from lack of support, prices in most departments dropped. The gilt-edged division were down; and Consols were adversely affected by the expectation of an early issue of Local Loan Stock. However, things were not at their worst at the close; and possibly they may be mending a little. The Money Market opened very easy; but the payment on Tuesday of the Consols issue instalment braced it up somewhat. So there is no apparent indication of any permanent hardness. In the Gas Market, business was extremely quiet; the volume of transactions being quite abnormally light. There were very few changes in quotation effected; and they were of small magnitude. But the tendency was downward; and all variations, with one exception, were in favour of easier prices. In Gaslight issues a little light business was done daily in the ordinary, at steady middle figures—a fraction above or below 96; and there was no indication of any tendency to move either way. Among the secured issues, the preference was moderately dealt in at medium prices. South Metropolitan was rather out of favour, and was done as low as 124 on Wednesday, with a drop of a point in the quotation. But it rallied to 125½ immediately afterwards. Commercials were hardly touched, and were unchanged. Scarcely anything was done in the Suburban and Provincial group; and all quotations were left standing. Transactions in the Continental Companies were few and far between, and were devoid of characteristic. Just at the close European was put down half-a-point. Among the undertakings in the remoter world, San Paulo was lower; but Oriental part paid advanced. It is understood that the Company have carried through to a successful issue their negotiations with the local municipal authorities to extend their contract for the public lighting of Calcutta for further terms of ten and fourteen years. Hence the advance in the price of the shares. Business in the Water Companies was of its usual mild description, and movements were few. Southwark recovered a couple of points from its recent fall; but Lambeth 7½ per cent. receded to a similar extent.

The daily operations were too slight and unimportant to call for particular notice. Suffice it to note that on Monday West Middlesex and Southwark Water rose 2 each. On Tuesday, Oriental new rose ½. On Wednesday, South Metropolitan receded 1, and West Middlesex Water 2. On Friday, San Paulo fell ½. On Saturday, European moved down ½, and Lambeth Water 2.

Freezing of the Water in the Scott-Snell Lamp.—Doubts may possibly have arisen in the minds of some gas managers (though they do not appear to have been expressed in the course of the discussion at the recent meeting of the Gas Institute) as to the efficient working of the Scott-Snell self-intensifying lamp in the event of the freezing of the water in the water-jacket. It may therefore be of interest to state that a trial has been made with the special object of ascertaining how the lamp would act under the exceptional conditions named. It was carried out at the refrigerating works of Messrs. Slater, Limited, at Battersea. The water container of the lamp was filled to overflowing after being placed in a room with a temperature 12° below zero. The lamp was left until the water had been completely frozen, when it was found that ice had been forced out of the hole used for filling the water-vessel, which is about 1 inch in diameter, and acts as a kind of safety-valve when the extra pressure due to the expansion of the ice takes place in the vessel. The lamp was removed from the refrigerating-room, connected with the gas supply, and started to intensify in three minutes. The pressure of the gas in the receiver was 21 inches, while that at the burner was 8 inches. The lamp was subsequently taken to pieces, when it was found that the gas receiver and the water-vessel were entirely unaffected by the severe test to which the lamp had been submitted.

PERSONAL.

Mr. HERBERT NIVEN, Manager and Secretary of the Gomersall Gas Company, has been appointed Gas Manager to the Ashton-in-Makerfield District Council.

Mr. J. H. WHITTELL, Manager of the Gas Department of the Haworth Urban District Council, has resigned this position, and accepted a similar one at East Ardsley.

Owing to the resignation of Mr. J. W. Gibson, Manager of the Haverhill Gas-Works, it has been necessary to appoint a successor; and Mr. G. F. CUTTING, of Hull, has been selected.

The Directors of the Portsea Island Gas Company have accepted the application of Mr. J. WENTWORTH, of the Sculcoates (Hull) Gas-Works, for the position of Works Superintendent, as advertised in the "JOURNAL" a few weeks since.

Mr. F. H. WOOD, of High Wycombe, has been presented with a travelling-bag by the employees at the gas-works, where he filled the position of assistant to Mr. J. F. Wicks, on leaving to take the management of the new works of the Shirebrook Gas Company.

Out of upwards of eighty applicants for the position of Engineer and Manager to the Aldershot Gas and Water Company, rendered vacant by the resignation of Mr. John Meiklejohn, Mr. G. P. LEWIS, who has been for about ten years assistant at the Crystal Palace District Gas-Works, has been selected.

Mr. WILLIAM FLETCHER, late Cashier of the Birmingham Corporation Gas Department, who, owing to illness, has retired prematurely after 42 years' service with the gas undertaking, was the recipient of a present from his colleagues last Saturday. A deputation, consisting of Messrs. Charles Hunt (Engineer of the Windsor Street Station), W. H. Powell (Cashier), S. R. Barrett (Fittings Superintendent), and C. H. Watkins (Hon. Secretary), was appointed to wait upon Mr. Fletcher, who is unable to leave his room; but, owing to the unsatisfactory state of his health, it was considered desirable that the presentation should be made privately. Mr. Powell, therefore, undertook the duty. The gift was in the form of a handsome silver casket, enclosing a purse, and accompanied by an engrossed resolution signed by a Committee of 24 gentlemen, representing every department of the gas undertaking, expressing the esteem, respect, and affection he had earned, and regretting the severance of the pleasant relations which had subsisted. The list of subscribers included the whole of the staff, both past and present, of the City Gas Offices and of the various works.

OBITUARY.

THE LATE MR. W. L. ROBINSON.

In the "JOURNAL" last week we gave a few particulars in regard to the life-work of the above-named gentleman, whose death on the previous Sunday it was then our painful duty to announce. We learn from the "Midland Daily Telegraph" that the deceased had been in failing health for some long time, and that he eventually succumbed to heart trouble. Mr. Robinson's commercial life, as we pointed out last week, was associated with gas manufacture. When he went to Coventry, he and his brother, the late Mr. Charles Robinson, became lessees of the Coventry Gas Company's works—this being one of several similar undertakings with which they were connected. Under their lesseeship, the business was made very successful. When, in course of time, the lease expired, the Company wished to regain possession of the property; and a new arrangement was entered into, under which Messrs. Robinson became joint Managers, though, under the name of "Robinson Brothers," they retained the gas-fittings department. This arrangement remained in force until 1884, when the Corporation acquired the undertaking. The fittings department was left in the hands of Messrs. Robinson, and was subsequently converted into the Coventry Gas-Fittings Company. Mr. William Robinson was a member of the Coventry Corporation, and was also on the Board of Guardians, on both of which bodies he did useful work. He served on various Committees of the City Council, and always evinced a keen interest in the business of the Corporation. As a member of the Gas Committee, his special knowledge was of great value to his colleagues. He vigorously supported the change made in the periodical tests of the gas when the proposal was brought forward for these examinations to take place at the Technical Institute instead of at the gas-works, as being more reassuring to the public. He showed his interest in the educational work of the city by allowing himself to be nominated for the School Board. He was returned to that body in 1888, and served three years—retiring in 1891. In all public duties he displayed an uprightness of character and devotion that made him a model representative. He was a Justice of the Peace for the county, having been appointed in 1884. We referred briefly last week to the late Mr. Robinson's generosity. Large-hearted liberality was characteristic of him. No genuine case of distress was ever brought under his notice without eliciting from him a kindly sympathetic response. His benefactions have softened many a sorrow; and those in need in the city have lost by his removal a sincere friend and well-wisher. Few citizens of Coventry have passed away whose loss is more deeply and truly deplored, especially by those who knew the goodness of his disposition, than William Leckie Robinson. The general esteem in which he was held was fully testified at his funeral, which took place last Thursday at the Coventry Cemetery. Deceased leaves a widow, six sons, and two daughters.

The funeral of Mr. WILLIAM RODGER, the Manager of the Bradford Road Gas-Works of the Manchester Corporation, whose death was noticed last week, took place at the Harpurhey Cemetery on the 15th inst. The *cortége* was accompanied by Alderman Gibson (Chairman of the Gas Committee), in his private carriage, Alderman Rushworth (Deputy-Chairman of the Bradford Road Sub-Committee), Mr. Marsden, Mr. Charles Nickson (Superintendent of the Gas Department), Mr. J. G. Newbigging (Engineer), Mr. Price (Deputy-Superintendent), Mr. Naylor (Deputy-Manager), and the foremen and a large number of the workmen from the several stations. A vast concourse of neighbours and friends assembled at the house, and at the graveside, to manifest the general esteem in which Mr. Rodger was held.

The funeral of Mr. WILLIAM MEDHURST, Manager and Secretary of the Folkestone Gas Company, whose death at Ventnor, after a lingering illness, was announced last week, took place on Wednesday; the first portion of the service being performed in St. Michael's Church, by the Vicar, the Rev. E. Husband. In addition to the members of the family, the body was followed to the Cemetery by the Mayor (Mr. Daniel Baker), members of the Corporation, and many friends. Public acknowledgment was made that Folkestone had lost a respected townsman by the flag over the Town Hall being at half-mast from the day of his decease to that of the funeral; and at the meeting of the Town Council on the latter day, the Mayor referred in feeling terms to the excellent services rendered by him to the town, to his business tact, and to the kindness of heart which was a prominent feature of his character. Their late friend was, he said, never lacking in giving advice and assistance to any person in distress; and he had never heard an unkind word spoken of him. He proposed a vote of condolence and deep sympathy with Mrs. Medhurst and the family in their bereavement. Alderman Banks, as one who had known Mr. Medhurst for many years, seconded the proposition, and bore testimony to the qualities of heart to which such feeling reference had been made by the Mayor. The motion was carried unanimously. Mr. Medhurst was in his 56th year; and two years ago he was placed on the Commission of Peace for the Borough.

We regret to record the death last Sunday, in his 78th year, of Mr. GEORGE A. BIDDELL, M.Inst.C.E., Chairman of the Ipswich Gas Company. Up to the spring of the present year, Mr. Biddell had been remarkably well and active; and it may be remembered that at the annual meeting of the Company in February he invested the proceedings with unusual interest by giving an account of the introduction of gas into the town. But of late his health had obviously failed; and on Wednesday last he was seized with paralysis, to which he succumbed. Mr. Biddell entered the great works of Messrs. Ransome, on the Orwell, in 1840. On completing his articles, he went abroad, but returned to the works in 1847. In 1850 he obtained an appointment in connection with the first Great Exhibition in London, and received the Superintendent's Medal and Diploma of Merit for his services while in charge of the Machinery Department. In his subsequent connection with the Orwell Works, he took the position of Chief Engineer, which he efficiently maintained for many years. In 1855 he represented the firm at the Paris Exhibition. After many years of faithful service, he retired. In 1883, he was invited to join the Board of the Ipswich Gas Company; and on the death of Mr. Sterling Westhorp in 1895, he was appointed Chairman. In this capacity, he not only took a great interest in the practical working of the undertaking—always acknowledging the valuable services of the Engineer and Secretary, Mr. J. T. Jolliffe—but showed that he had a full appreciation of the necessity of keeping pace with the times. His addresses at the annual gatherings of the Company were always full of information; for he was "thorough" in whatever he undertook. He was never connected with the official life of the town; but he associated himself with the work of the parish of Holy Trinity, of which he was for 46 years Vicar's Warden. He was regarded as the "father of the parish." His generosity was proverbial; and he was a ready supporter of every good movement. His colleagues on the Board of the Company, the officials, and every workman, will miss one whose kindly manner could not fail to endear him to them. Deceased leaves a widow, but no family.

NOTES.

Professor Caldwell on the Electrolysis of Pipes.

Some interesting information concerning an electrolysis survey at Columbus, Ohio, has been published in the "Engineering Record," on the authority of Mr. Julian Griggs, the City Engineer. The survey was conducted by Professor F. C. Caldwell, of the Ohio State University. The importance of the investigation lies in the fact that Columbus is almost the only city where the electric railways are required to be worked upon the "double trolley or an equivalent system;" and the Corporation wished to know how the requirement was being satisfied by the Company. Many readings were taken throughout the city to ascertain the difference of electric potential between the pipes and the rails. It was found

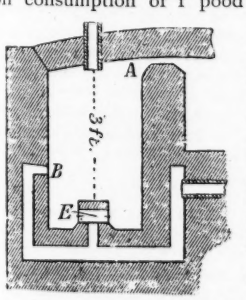
that, where the bonding of the rails was in good order, the potential difference varied between small positive and negative values. On the whole, there was no point where serious general danger from electrolysis seemed likely to occur. Many tests were made of the actual amount of current passing in the pipes. In the result, it was recommended that the Railway Company should be required to make and maintain upon all the lines, thoroughly good systems of bonding, including cross bonding of the two rails. All rails ought to be surrounded by thick concrete. Insulated return feeders must be used, so as to keep the drop of potential along the rails as low as possible. As regards new mains, it is recommended that these should, as far as practicable, be laid in alleys. The sockets should face the direction from which the current will flow, if it is present. Coated pipes should be used; and after the socket joints are made in the usual way, the whole joint, and 6 inches of the pipe beyond, should have a coat of asphalt. Professor Caldwell remarks that there is no advantage to the Railway Company in letting any current return by the pipes.

Benefit of the Export Coal Trade.

Lieutenant C. W. Bellairs, R.N., recently read a paper before the Colonial Section of the Society of Arts, on the "Coal Problem and its Relations to the Empire." The particular aspect of the subject to which Lieutenant Bellairs addressed himself was the consequences that may be expected to ensue to the Empire from the gradual exhaustion of the coal capital of the United Kingdom. He referred to the report of the Royal Commission of 1871, when it was thought that the exportation of British coal had attained its greatest proportions. The Commissioners stated that our coal exports would never exceed 13 million tons. It is a striking commentary on the vanity of human prophecy that they have already risen to more than 46·6 million tons, besides 12 millions in bunkers. Lieutenant Bellairs recognizes that the orthodox free trade view of this fact would be that coal is exported because we have greater need of something in exchange; that it enables foreign railways and our own and foreign ships to bring this something else to us cheaply; and, finally, that pig iron, steel, ships, and manufactures, having used coal in their production, are, in effect, exports of coal. He, however, is willing to acknowledge that this is a form of argument based on the perfection of theory in a frictionless universe, and that something must be allowed for the compromise of practice in a warring world. After marshalling the facts, the author concludes that the export coal trade is the mainstay of the shipping trade of the United Kingdom; so that it would be undesirable to restrict the former trade. He suggests that the requirements of the Navy can be met by the State purchase of adequate mines. Also, it is remarked that there is a real need for interference in the coal mining industry in the interests of economy, for the provision of reserve coal, and for the prevention of strikes. Unfortunately, the nature of this interference is left undefined.

Krusell Oil-Furnace.

It is reported that in Russia petroleum residues are being used as fuel for metallurgical purposes, by means of the Krusell furnace, the essential character of which is shown in the accompanying illustration, taken from a Russian source. There is a combustion chamber with a minimum height of 3 feet, since with a less fall the oil dropping from the pipe at the top is not gasified before reaching the bottom. Starting upon the basis of an oil consumption of 1 pood (36 lbs.) per hour, for every such quantity the combustion-chamber must have a content of from 12 to 15 cubic feet. The sizes of the air-channels E and B, and of the outlet-flue A also depend upon the oil consumption. Every pood of oil burnt per hour requires 8000 cubic metres of air, or 2·22 cubic metres per second. Hence, with an air current moving at the rate of 20 feet per second, B and E must have a sectional area of 16 square inches. The area of the outlet A must be 86·4 square inches, with a height of $3\frac{1}{2}$ inches. The chamber here shown may have a length of 18 inches, and a width of 3 feet; thus giving a cubical content of 13·5 cubic feet. The air supply, which gets heated in the brick channels through which it passes to the furnace, is divided between the openings E and B. The area of the latter is about one-third or one-fourth that of the three together, and it is at a height of at least one-third of the height of the chamber above the floor. The liquid fuel is fed through a couple of $\frac{1}{2}$-inch gas-pipes, bent into syphons outside, with cast-iron nozzles inside the chamber. The oil is warmed by the pipes lying in the brickwork of the crown of the furnace. The idea is for the oil to drip upon the small hearth over the air-inlets E; and the second air supply is directed to impinge upon the same spot. This prevents coking. A temperature of 1200° C. is generated in the furnace. On the other hand, this can be converted into a gas-furnace for heating retorts, &c., by making the second air supply enter on the other side of the bridge.



We learn from the "Standard" that Sir Alexander Binnie, Engineer of the London County Council, intends shortly to resign this position in order to commence practice as a consulting engineer.

TECHNICAL RECORD.

GREAT GATHERING OF GAS AND WATER ENGINEERS IN VIENNA.

[From Our Special Correspondents.]

Upwards of a thousand gas and water engineers and their friends assembled in Vienna last week on the occasion of the Forty-first Annual General Meeting of the German Association of Gas and Water Engineers. The selection of Vienna for the place of meeting was a specially happy choice; for probably no city in the world at the present time offers so many features of direct interest to gas and water engineers. The immense new Central Gas-Works, recently erected at enormous cost by the Municipality (of which a specially written account has already appeared in the "Journal," *ante*, pp. 812, 874); the use made of incandescent gas lighting, almost to the exclusion of other methods of illumination; and the display of gas and water appliances at the Gas and Water Trades' Exhibition which opened on May 25—all contributed to make Vienna the most appropriate spot for a great assembly of gas engineers this year. In addition, Vienna appeals to gas men the world over because it possesses the factory whence the fluid with which the various Welsbach Companies in Europe impregnate their mantles emanates, and because it is there that Baron Auer von Welsbach has worked out the details of his epoch-making invention of the incandescent gas-mantle. The great and elaborate schemes for the water supply of the city—partially completed and partially in progress at the present time—make it no less a centre of attraction to water engineers.

Hence it is not surprising that the gas and water men of the Continent were flocking thither in their hundreds on Saturday and Sunday, the 15th and 16th inst.; so that even the resources of the railways which converge there, and of the great hotels of the city, were severely taxed. The list of those who had arrived at the time of the assembly on the Sunday evening contained over 750 names, of which about 150 were those of lady relatives of the technical men. The list would, of course, be swelled appreciably by later arrivals. The names include representatives of almost every Continental country (France, we think, excepted), though of course Germany and Austria-Hungary are responsible for the major part of the list. But Russia, Roumania, Denmark, Sweden, Holland, Switzerland, Norway, and Belgium each contributes several; and America also appears. But, sad to relate, the two representatives of the "Journal" seem to be the only professional men connected with the gas industry who are here from Great Britain.

Most elaborate and complete arrangements had been made by an energetic Local Committee for the accommodation, instruction, and entertainment of this great concourse of people. The programme reflects immense credit on the Honorary Committee, and especially on its Secretary, Herr W. Kefer, who must have neglected his large engineering shops in the town for many days in order to cope with the task which he and the Committee had undertaken. Those whose acquaintance with meetings of Gas Associations is limited to those of the English bodies, can have but a poor conception of the work involved in engineering a great Congress, such as that which has just closed at Vienna, in the thorough manner in which it was done. Valuable books descriptive of the city gas and water works, replete with views and plans, were placed in the hands of each visitor, in addition to special guide-books to the sights of the place, and a highly artistic album with descriptive notes in three languages. The Municipality, too, came to the aid of the Committee; and at the instance of the Burgomaster, the "notorious" Dr. Lueger, who has been in no small measure directly responsible for the undertaking of the local gas supply by the city authorities, accorded a hearty reception to the gas and water men. If we add that perhaps in no place in the world is hospitality conceived in a more generous spirit than in Vienna, it will be recognized that all who attended the meeting had an exceptionally pleasant time.

The meeting opened on the evening of Sunday, the 16th inst., with a supper and concert provided by the Local Committee, in the Pump Room of the City Park. This fine room was rather small for the 800 or so guests; but otherwise all went on in extremely merry fashion. Herr Nachtsheim, of Vienna, a civil engineer and editor of "Der Gastechniker," welcomed the visitors in the name of the Local Committee, and referred to the changes which had taken place in the city since the German Association last met there, 30 years ago. The President of the Association, Herr Beer, the Manager of the Berlin Municipal Water-Works, in his reply, congratulated the Local Committee on the perfection of the arrangements which they had made for the reception of the visitors. Herr Zimmermann, the Manager of a large gas-apparatus factory at Mayence, delivered a humorous composition in verse, which was received with much applause. Music and good cheer prevailed until midnight.

The business sittings commenced on Monday, the 17th inst., in the magnificent and capacious Concert Hall at the Musical Association's rooms. In other rooms in the building were exhibited a large number of plans and photographs of gas and water works, models, and small pieces of apparatus, of which more will be said anon. The chair was taken at 9 o'clock by the President of the

German Association, Herr Beer, who offered a few words of welcome. Then Baron von Call, the Minister of Commerce, expressed the sympathy of the Austrian Government with the objects of the meeting, and referred to the common interests of the gas and water engineers of Germany and Austria. Next Dr. Lueger, the Burgomaster of Vienna, welcomed the members to the city, in a very eloquent speech, in which he expressed his high appreciation of the services rendered to the community by technical men such as those assembled. He referred to the completion of the city gas-works, an undertaking which showed that the Municipality were fully alive to the great future of the gas industry—a future which had been ensured by the labours of his fellow-citizen, Baron Auer von Welsbach. In a few years, when the new water-works were completed, the supply of water to the city, which was already good, would be unsurpassed in Europe.

The representatives of the Government and City were thanked for their attendance and sympathetic remarks, and they then withdrew. The technical programme of the meeting was thereupon commenced.

The President's Address.

The Presidential Address of Herr Beer reviewed the progress made by the German Association during the 30 years which have elapsed since it last met in Vienna. Then, he said, it numbered only 163 members; to-day 671 belonged to it. He considered that the International Gas Congress in Paris last year had done much to strengthen the bonds of sympathy between technical men of all nations. Political differences should, he thought, have no part in technical affairs, which should be regarded as of international importance.

The New Municipal Gas-Works.

The first communication was a paper by Herr Kapaun, on "The Construction of the Municipal Gas-Works of Vienna." The author recounted the story of the efforts made by the Municipality, from 1872 onwards, to take into their own hands the gas supply of the city, which nevertheless remained for the most part with the Imperial Continental Gas Association until the 31st of October, 1899. The Austrian Gas Lighting Company supplied a small district, which still remains in their hands. But from the 1st of November, 1899, the greater part of the district hitherto supplied by the Imperial Continental Gas Association began to receive its supply from a new works erected by the Municipality, at enormous cost, on a site adjoining both the Danube Canal and one of the railways which gives communication with most parts of Austria. Several schemes had been propounded for the erection of a Municipal gas-works between 1872—when Herr Kühnel, of Trieste, brought out the first—and the autumn of 1896, when the scheme which has actually been carried out was discussed and accepted by the Committee elected to supervise the erection of new works. This was substantially one which had been proposed some time earlier by Herr Herrmann, the Consulting Engineer to the Municipality, who with Herr Kapaun superintended the construction of the works. Herr Herrmann has already given in the pages of the "Journal" a special description of the work carried out (as already mentioned), and actually Herr Kapaun's paper contained very little information which has not thus been already laid before English gas engineers. Nevertheless some of the figures quoted by Herr Kapaun are sufficiently interesting to bear reproduction in our pages.

The erection of the new works practically commenced on the 28th of December, 1896, when a start was made on the four gasholders, each of which has a capacity of about 3,200,000 cubic feet. These are, in accordance with the common practice in that part of the Continent, within houses, which are of a highly ornate character. Consequently, the guide-framing of the holder is of the simplest type. The first pair of gasholder-houses was finished by May 10, 1898, and the holders themselves were ready for use on July 17, 1899. The retort-house, containing 1620 inclined retorts, in settings of nines, was also carried out in similarly rapid fashion. The chief feature of the work was the speed at which it was erected. There were used in the construction 41½ millions of bricks, about 38,000 tons of cement, and about 13,000 tons of ironwork; while the weight of the distributing and other mains was over 6000 tons. The work was actually carried out in 2¾ years. The only things taken over from the Imperial Continental Gas Association were the consumers' meters. Such is the work of which Herr Kapaun gave an account. We shall give shortly further details of these works, which were visited the following day by the members attending the meeting.

The account of the construction of the gas-works was followed by a paper on the manner in which work was started at them, by Herr Wobbe, the Manager. He described at length the steps taken to prevent explosions during the blowing out of the air from the gasholders, plant, and huge distributing system. For the sake of safety, flue-gas was made in a special plant erected for the purpose according to plans by Dr. Strache; and the air was, in the first instance, expelled by this flue-gas. The flue-gas was subsequently expelled by coal gas, which was lighted as soon as possible at flat-flame burners, which were afterwards replaced on the consumers' fittings by incandescent burners. The flue-gas was blown into the distributing mains from the 24th to the 28th of September, 1899. On the latter date, coal gas was first introduced; and by the 13th of October the quality at the burners was sufficiently good to admit of the use of incandescent burners. About 21,000 of these burners were fitted between the 13th and the 25th of October, 1899.

A Lecture by Baron Auer von Welsbach.

After Herr Wobbe had read his paper, Baron Auer von Welsbach gave a lecture. Unfortunately he was all but inaudible in the large concert-hall, which was ill-adapted for speakers unaccustomed to the lecture-room or debating hall. He traced the history of the development of the incandescent gas-light in a very interesting manner. At the outset, he introduced to the meeting his fellow worker, Herr F. Kuschenitz, who is now the Manager of the Austrian Incandescent Gas Light and Electricity Company. He then went on to say that it was soon after 1880 that he began to take an interest in the chemistry of the rare earths. The remarkable property displayed by many of these earths, of glowing when brought into a flame, had attracted his earnest attention. The rare earths differed from other bodies in radiating green light. Scientific knowledge offered no explanation of this property. He then, with Herr Kuschenitz's aid, showed, by impregnating cotton filaments and afterwards igniting them, how the rare earths behaved. It was the happy idea of a journalist, who wrote an account of the discovery, to give the light the name of "incandescent gas-light," which it has since kept. The Press spoke well of it; but directors of gas concerns and others, who should have been interested in it, scoffed at it as a plaything. This treatment did not deter him; and the light began to be adopted, and spread within moderate bounds. But he was for a time occupied fully with other scientific work, and neglected the incandescent light, until he found in Dr. L. Haitinger, the present Chemist of the Austrian Incandescent Gas Light and Electricity Company, a man of rare ability and energy, who (leaving work of a totally different character) proceeded to develop the light. Dr. Haitinger's most important observation was that it was the combination of cerium in the impregnating fluid which, in particular, developed the highest degree of radiation from the mixtures of earths. Later, he (Baron Welsbach) was able again to take up the matter; and hundreds of experiments were made with a view to improving the light obtained from the mantles, but without any valuable result. The incandescent gas-light industry came to a standstill; those who held aloof at first pointed out that their attitude had been justified by events; and those who had launched capital in it became clamorous. Then—instead of a quiet time for research, with the object of securing improvement—he was troubled by patent litigation. Experiments appeared fruitless, until at last, in the course of further scientific work, he observed that the thorium preparations radiated very little light when they were nearly pure, and that a small admixture of cerium was necessary for the production of a highly illuminating mantle. Further researches showed that an admixture of about 1 per cent. of cerium gave the best effect; and with this observation the modern incandescent gas-mantle was discovered. The durability of these new mantles in use was good; and hence they were adapted at once for putting on the market. The development of the incandescent light in the manner indicated was not like that of many inventions. The advance was gradual and step by step; the work was tedious; and no external help was given to the worker. Then came the patent actions, when people endeavoured to show that they had found in old books and early experiments on incandescence the secret of the invention. The incandescent gas-light had been developed in Vienna; and neither he nor his small band of assistants had in any way availed themselves of the inventions or ideas of others in bringing it to a successful issue. In conclusion, he said that he hoped to propound a new theory of the incandescent gas-light.

Hearty thanks were given by the President to Baron Auer von Welsbach for his highly entertaining lecture, which was received with great applause by those present.

Dr. Bunte on Gaseous Explosives.

Dr. Bunte, of Carlsruhe, followed Baron Auer von Welsbach, with a very interesting communication on "Explosive Mixtures of Gases." He illustrated many of the points to which he referred by experimental demonstrations—thus adding greatly to the attractiveness of his lecture. He referred to the fact that the explosive qualities of certain gaseous mixtures were very useful in many ways, especially in connection with the operation of gas-engines, &c., and were not to be regarded as a source of unmitigated nuisance by technical men. Extraordinary advances had of late been made in the application of the explosive force of mixtures of gas and air; and gas-engines of over 1000-horse power were now in successful operation. On the other hand, the explosive mixtures which occurred in coal mines were a source of great danger to life and destruction of property. Similar explosive mixtures of gas and air might occur in the manufacture and distribution of coal gas, water gas, Dowson gas, &c. The researches of Sir Humphrey Davy, which resulted in his invention of the safety-lamp, and the investigations of Bunsen, Le Chatelier, and others, had thrown much light on the occurrence and properties of such mixtures. Some of his pupils, notably Dr. P. Eitner—whose investigations in connection with the carburetting of gas are familiar to readers of the "Journal"—had more recently taken up the further investigation of the subject. By experiments (which were repeated by the lecturer), the effect of pressure and of small orifices in retarding and preventing explosion in mixtures which, under other conditions, were explo-

sive, was illustrated in a most convincing manner. The knowledge of the properties of explosive mixtures of air and gas, which had now been acquired was, Dr. Bunte said, capable of valuable application in many directions, especially in the improvement of gas-engines and incandescent gas-burners.

Several diagrams were exhibited by Dr. Bunte, showing the proportions in which air and different gases formed explosive mixtures. Of the numerous gases referred to in these diagrams, carbonic oxide was at one end of the scale—a higher percentage of it being required than of the other gases to constitute an explosive mixture with air; and pentane at the other end. A very small percentage of gaseous pentane makes air explosive. Water gas was but little more liable to form an explosive mixture than carbonic oxide; while coal gas stood about midway between carbonic oxide and pentane in this respect. We hope shortly to be able to give a fuller report of Dr. Bunte's communication, which was listened to with the greatest interest by those present.

Differential Prices for Gas.

After a short adjournment for luncheon, Herr W. von Oechelhaeuser proceeded to read in a clear and highly effective manner a paper which he had prepared, on "The Question of Differential Gas Prices." This question is one which appeals far more directly and forcibly to the German gas manager than to his English *confrère;* for, in the majority of German and Austrian towns, there is one price for gas used for illuminating purposes and a lower price for gas for heating or power purposes. Increased attention has, however, been given of late to this question even in England; and we shall therefore shortly reproduce Herr von Oechelhaeuser's highly interesting paper on the subject. The following indicates the lines on which he dealt with it.

The differential-rate question had lately assumed a new aspect in Germany, because some towns—such as Berlin—had adopted a uniform price for gas for whatever purpose it was used. On the other hand, in some cases the price during the summer months had been made considerably lower than the price during the winter months. Both these systems aimed at avoiding the duplication of services and meters which was rendered necessary when gas was sold at different rates according to the purpose for which it was required. But there were two great disadvantages of the uniform-price system. On the one hand, it lowered the price of gas for lighting purposes to an unnecessary extent; and, on the other hand, it jeopardized the more extended use of gas for driving motors, which after all was the best description of consumption which the gas industry could desire. The use of gas for technical purposes, on a large scale, also deserved the fullest encouragement. The conditions of changes of price varied with local conditions; but any changes made should specially aim at increasing the consumption by gas-engines. This could be accomplished by dual rates, even by adopting one rate for the summer months and another for the winter months. Then gas for purposes other than lighting should be sold at a rate which, taking the whole year through, would not exceed the lower rate which would otherwise be charged for it. By such a scheme, it would be possible to reduce the number of duplicated services and meters, and yet maintain the consumption of gas by gas-engines and for other technical purposes. The adoption of differential rates in other industries—for instance, electricity supply, and, in Germany, the spirit industry—rendered their adoption in the gas industry also highly desirable. Electricity showed a difference in price of as much again according to whether the current was used for lighting or for other purposes. From tables and diagrams which the author had prepared, it was evident that gas lighting had become cheaper, even since the invention of the Welsbach light, owing to the improvements in burners and mantles; so that, wherever the price of gas was at all reasonable, it afforded far cheaper lighting than any other means. On the other hand, the competition of electric motors, and the question of smoke abatement, imperatively demanded a reduction in the price of gas for heating, cooking, and power purposes.

The earlier experiences of his own Company (the German Continental Gas Company) with differential prices, had proved their advantage; as was clear from some diagrams which he placed before the meeting. In future, the Company would aim at increasing the present difference in the prices, by maintaining the price of gas for lighting purposes, while reducing that of gas for other purposes, until the latter was at least 50 per cent. lower. This was the system in operation at Düsseldorf, Bochum, Elberfeld, Mulheim-on-the-Ruhr, and some other German towns, where there was even a difference of 66 to nearly 80 per cent. in the price charged for electrical current according to the purpose for which it was wanted. The interests of the gas industry and the common weal both demanded the retention and extension of the system of differential prices.

A prolonged and lively discussion followed the reading of this paper. Herr Shimming, the Manager of the Berlin Municipal Gas-Works, defended the system of a uniform price, and pointed out that users of large gas-engines would always find it more economical to employ Dowson or some similar gas than coal gas. Herr Merz, the Manager of the Cassel Gas-Works, was also in favour of a uniform price; but Herr Müller, of Charlottenburg, was against it. Herr Schäfer, of Dessau, supported the reader of the paper; and Herr Körting, of Hanover, Herr Joly, of Cologne, Herr Gröhmann, of Düsseldorf, and Herr Muchall, of Wiesbaden, also joined in the discussion, to which Herr von Oechelhaeuser replied in a very effective speech. Broadly, it may be said that those connected with municipal gas-works favoured the uniform price, and those who were engaged at works owned by gas companies favoured differential prices, which it was argued, with a considerable show of reason, were more conducive to the return of good profits to the gas undertaking.

Herr von Oechelhaeuser's reply brought the technical proceedings of the first day (the 17th inst.) to a close. In the evening, those attending the meeting went to a performance of "Das Erbe" (The Inheritance), by F. Philippi, in the lovely Hofburg theatre, and afterwards supped together in the Volksgarden.

Water Supply Topics.

The morning of the following day (the 18th inst.) was devoted to the reading of communications dealing with water supply. The first was by the Chief Constructing Engineer of Vienna, Herr Berger, on the water supply of the city. It showed how from once bad conditions, progress had been made, until now a supply of well water of excellent quality was provided. The quantity was somewhat deficient; but this fault was being rectified by the construction of a second works. When these were completed, Vienna would have an unsurpassed supply, both in respect of quality and quantity. It transpired in the course of the reading of the paper, and of the visits to the works on the following day, that the water supply had been obtained regardless of cost, as is the case with every undertaking of the Municipality of Vienna. The rates of the city are enormously high—in no small degree because of the extravagant expenditure on ornate buildings, &c., in connection with even the most utilitarian matters. Such is the price paid by the Viennese for the luxury of democratic and socialistic municipal government.

Next Herr O. Smreker, of Mannheim, described a scheme for the water supply of Prague; and then Herr Herzberg, of Berlin, gave a paper on the water supply of some North-Sea bathing resorts. A communication by Herr H. Peter, of Zurich, on the purification of water by coarse and fine filter-beds, brought the day's sitting to a close.

Visit to the New Municipal Gas-Works.

In the afternoon, the members visited the New Central Gas-Works, erected by the Municipality, to which reference has already been made. They proved singularly disappointing; but to this matter we propose to revert in a description of the works, which will be given shortly in the "Journal," as a supplement to the account by Herr Herrmann which has already appeared.

A Monster Banquet.

On the evening of Tuesday, the 18th inst., a truly regal banquet was given by the Municipal Council of the city to those attending the meeting. Over 1000 were present; and never before has so large an assemblage of gas and water engineers been entertained on so lavish a scale. The Burgomaster, Dr. Lueger, presided in the magnificent hall of the Town Council House; and his striking personality was displayed to excellent advantage. In eloquent speeches, he referred to his great interest in technical matters, and to the confraternity of the German and Austrian peoples. The toast-list was a long one; and speeches were made by Herr Beer, on behalf of the German Association, and by Herr W. von Oechelhaeuser, Professor Bunte, Herr Söhren, and Herr Nachtsheim. The party finally broke up about 3.0 a.m. There was an immense concourse of the populace of Vienna in the neighbourhood of the Council House during the evening to gaze at the illumination of the interior, which formed a very striking spectacle both from within and from outside. It was carried out partially by means of arc and incandescent electric lamps, and partially by means of gas. The result was a blending of tones and intensities which had a very beautiful and impressive effect, that was greatly enhanced by the fine surroundings of the Council House.

The Analysis of Gases.

The proceedings on the third day—the 19th inst.—opened with a description, by Dr. Strache, of Vienna, of some forms of gas-analysis apparatus devised by him and Dr. Jahoda, for the quick measurement and analysis of gases. He referred to the great utility, especially in water-gas manufacture, of a rapid method of ascertaining the rate of flow of gases, and described the means he had adopted in his investigations on the theory of the water-gas process, which have already been the subject of a series of articles in the "Journal" (*ante*, pp. 27, 87, 145, 208, 275, 401). Briefly, he throttles the stream of gas in a pipe, and measures the pressure before and after. The difference in the pressures observed affords an indication of the rate of flow of the gas in the pipe. Since, in the articles already referred to, it had been shown that the efficiency of a water-gas generator depended on the proper rate of flow for the particular temperature of the bed of fuel being maintained, such a rapid means of ascertaining the rate of flow became, in his opinion, very valuable. It was also of service in other methods of gas manufacture; for it enabled the rate of flow of gas to the burner on a photometer to be adjusted far more rapidly than was possible by means of the meter alone. The same method could be introduced, with advantage, in technical gas analysis. He had also devised apparatus (which he exhibited and explained) for carrying out analyses of gas with great rapidity. This apparatus, though simple in operation, cannot be clearly described without reference to an illustration. An account of it will be given shortly in the "Journal." Dr. Strache also showed

an apparatus for the detection of leaks from gas-services, &c. It depended for its action on the different rates of diffusion of gases —*e.g.*, hydrogen and nitrogen or oxygen—through a porous porcelain diaphragm. The travel of a pointer over a scale indicated approximately the quantity of gas present in the air. Some references to other forms of apparatus for use in connection with the analysis of gas concluded the communication, which was very highly appreciated by the audience.

A paper was also read by Herr E. Prinz, of Berlin, on the removal of iron from water which was contaminated with it.

The German Association's Annual Report.

The Annual Report of the German Association was presented by the President, Herr Beer. It referred to the valuable character of the International Gas Congress held at Paris last year. One result had been the establishment of a Commission to settle standard conditions for testing the light afforded by incandescent gas-burners; on which Commission France, Germany, and England were equally represented. The Commission hoped to meet at Zürich in the autumn. The report referred sympathetically to the loss sustained by the gas industry in the deaths of Bunsen and Pettenkofer. The good services rendered by the Association in connection with the removal of restrictions on the use of gas-lighting in certain districts where the public authorities had shown preference, on the score of security from risk of fire, for electric lighting, were mentioned, as were also the continued endeavours to obtain the admission of foreign gas-oil, suitable for the manufacture of carburetted water gas, into Germany free from the exorbitant import duty which is at present imposed on all petroleum oils. After some allusions to the progress of gas-lighting in Germany in the past year, the report went on to state that the membership of the Association showed a net increase of 16 during the year. There were now 830 members of all classes. Then followed particulars of the eight branch or affiliated Associations, and of their meetings during the past year. The Mark Association numbered 179 members, and had held its twenty-first annual meeting. The Mid-Rhenish Association possessed 167 members, and had met for its thirty-seventh annual gathering. The Association of Gas and Water Engineers of Silesia and Lansitz had met for its thirty-second year, and had received several valuable technical papers. The Rhenish and Westphalian Association had a membership of 270. The Bavarian Association possessed 116 members. The Baltic Association was in its twenty-ninth year. The Association of Saxony and Thuringia had held its forty-seventh annual meeting, and numbered 148 members. The Association of Lower Saxony had a membership of 110, though only in its third year of existence. The report concluded with references to the satisfactory financial position of the German Association. It was forthwith adopted by the meeting.

Then followed the election of officers for the ensuing year. Herr E. Beer, the present President, was re-elected to that office. It was decided that the Association should meet next year at Düsseldorf, where there will be an important Industrial Exhibition. The formal business thereupon concluded.

The valuable reports of the various Committees appointed by the Association, to report on different matters of importance to the gas and water industries, were referred to in the course of the annual report, and were laid *in extenso* before the members. Several of these reports will be summarized in the "Journal" shortly. They illustrate the great services which a large and united Association, well endowed with funds, can render to the industries it represents.

The Excursions.

At the close of Wednesday's sitting, excursions were made in five groups to various places of technical interest to the members. Two were to water-works in connection with the Vienna water supply; two to important new works for regulating the flow of the Danube with its canal and tributaries; and one to a new railway. On the whole, they were well attended, despite the unfavourable weather. In the evening, the members assembled in the "English Garden," the attractions of which are similar to those of the "Exhibitions" now annually held in London at Earl's Court. The cold weather, which had so far rendered open-air amusements almost impossible, however cleared the grounds at an early hour. Fortunately the following day, Thursday, was brighter and milder; and an enjoyable excursion was made to the Kahlenberg, a well-wooded hill in the suburbs, from which an extensive view over Vienna and the surrounding country is obtainable. At supper here, the parting speeches were made; and on the following day the majority of those who attended the meeting were homeward bound.

The meeting as a whole was a most characteristic success, especially so far as the entertainments and social functions were concerned. The technical communications were not below the average in merit, though there was a preponderance of papers on water questions—perhaps in consequence of the President for the year being a Water-Works Engineer. The Local Committee did yeoman service to the Association, in making excellent arrangements for the meeting. There was a special programme for ladies on each of the days when the sittings were held.

The absence from the meeting of all the Engineers, &c., connected with the Imperial Continental Gas Association was a matter freely commented upon. It did not cause surprise; for the general opinion of their brethren from Germany appeared to be that the Imperial Continental Association had received very shabby and unfair treatment indeed at the hands of the Vienna Municipality.

We ought to add in correction of an earlier statement that Great Britain was represented at the meeting by Mr. S. Simmelkjör, of the Cagliari Gas and Water Company, as well as by the two representatives of the "Journal."

Next week we shall refer to the exhibits at the Gas and Water Trades Exhibition at Vienna.

SOUTHERN GAS ENGINEERS AT BOURNEMOUTH.

Last Thursday morning the private barometers and the weather forecasts of the newspapers were studied by many gas managers in the southern counties of England; it being the day which the respected President of the Southern District Association of Gas Engineers and Managers (Mr. Corbet Woodall) had arranged for the excursion meeting to be held at Bournemouth, the gas and water works of which town are under the management of one of his sons—Mr. Harold W. Woodall. But, although the weather oracles did not inspire any great hope, the consulters comforted themselves with the thought that they had aforetimes found them lapsing from the truth; and with the hope that it would be so on this occasion, some fifty members left their homes armed with the necessities for meeting emergencies. It rained on and off during their stay in Bournemouth. But thoughtful provision, in the way of closed carriages, had been made by Mr. Harold Woodall; and when the visitors bid him adieu in the evening, there was not one, we venture to say, who regretted his leaving home in the morning.

The London contingent, made up of the members from London and the adjoining counties, left Waterloo by the 9.30 train; and in the company were the President, his son and right-hand in his professional work (Mr. Henry Woodall), and the Hon. Secretary (Mr. James W. Helps). Arriving at Southampton West, the travellers found on the platform the President of the Gas Institute (Mr. S. W. Durkin—himself a member of the Southern), who being prevented from joining the party had come to wish them an enjoyable day. Members from the neighbourhood and the Isle of Wight joined the train here. Alighting at Branksome, the company were met by their local colleague, and were at once driven to the gas-works in the Bourne Valley. Of the Board of the Company supplying the demands of Bournemouth in the matter of gas and water, Mr. Corbet Woodall is a member; but during the day he only comported himself as the President of the Association, and left to Mr. R. Hesketh Jones, one of his colleagues on the Board, the entire honour of representing the hosts of the day. By him, the party were received at the works.

The Progress of the Gas Undertaking.

Here we may introduce a few particulars regarding the gas and water undertakings. It was away in 1856 that Mr. Edwards Woods entered into an agreement with the Bournemouth Town Commissioners for the supply of gas to the town; and the Company which was subsequently formed added the supply of water to their duties in 1864. At this time, the works gave employment to three men, exclusive of the secretary. There were two gas stokers and the manager. The latter, in addition to his duties as manager of the gas-works, looked after the pumps for the water supply, attended to all repairs, and was, in fact, resident engineer. In 1865, the consumption of gas was 5 million cubic feet; the output last year was 330 millions. These comparative figures are of marked interest. But let it not be thought that the latter figure has been built up by uniform increases year in and year out over the whole of the period. The last ten years are the ones in which there has been the most striking development—the increase in the decade having been no less than 81·2 per cent. Last year accounted for 10·97 per cent.; and this in a fashionable watering-place, where electric lighting has been considered to be a proper attribute of *le beau monde*. The population in the district of supply is estimated at 75,000. The number of ordinary gas consumers is 4530; of prepayment, 3234; and of public lamps, 1712. The mileage of gas-mains is 86. The capacity of the coal-gas plant is 2 million cubic feet daily, and of the water-gas plant 1 million. The capacity of the holders is 2,300,000 cubic feet. The illuminating power of the gas supplied is 15·5 candles, and the price 3s. 4d. per 1000 cubic feet.

Inspection of the Works.

In conducting the members round the works, in pointing out the features of interest, and in answering inquiries, Mr. Harold Woodall was aided, in an admirable manner, by his assistant (Mr. H. C. Head) and the Works Superintendent (Mr. W. H. Green). Those of the party who were members of the old South-West Association, and inspected the works on the occasion of the visit there in 1892, saw that the lapse of eight or nine years had produced several changes, in order to bring the works up to date; and further extensions are in progress. In the retort-houses (one of which was designed by Mr. Corbet Woodall some seventeen or eighteen years ago), there are 23 beds of seven through retorts, with regenerative furnaces; and the water-gas plant (which was erected by Messrs. Humphreys and Glasgow, and was started in

February last year) consists of two sets, of 500,000 cubic feet each. The information was given that the plant has afforded every satisfaction, at all times exceeding in ordinary working the makers' guarantee. The coal gas can be divided into two streams from the foul main. No. 1 stream passes through a wall condenser, Cutler condenser, Livesey washer, "Standard" scrubber, and a set of six 20 feet square purifiers. No. 2 stream flows through a wall condenser, Cutler condenser, a Livesey washer, and a Walker tower purifying-machine, to six 25 feet square purifiers. It was noticed that at the present time excavations have been completed for a third installation of purifiers, which will be 30 feet square, and will allow of a separate stream being given to the water gas. Passing the station-meter house, it was observed that an extension is being made there; and a new Parkinson meter is being put in. A useful accessory to the ordinary plant which has just been added by the Engineer, and which came in for a minute inspection, is a Sturtevant fan, driven by a vertical two-cylinder Westinghouse gas-engine, which will pump from either holder into the other, or from a light holder direct to the inlets of the governors. The means by which the coal is dealt with from the adjoining railway were also examined with interest. The coal travels down the adjoining high railway embankment in shoots, which discharge into waggons, which in turn run on an overhead railway, and distribute the coal either into the retort-houses or put it into store. A Peebles oil-gas plant was noticed; but it is only used now when the water-gas plant is not in action—the experience being that a better value is obtained from the oil by the latter system than by the former. The Botley carburation process for the prevention of naphthalene deposits is in use; and Mr. Woodall is proposing to keep exact records as to its actual effect in fulfilling its purpose. These, we feel sure, will prove of considerable interest to the profession generally. The Company are fortunate in possessing ample ground for future development, and around and in the less frequented parts of the works, there is a profusion of flowers and foliage whose healthiness and beauty were silent protests against any thoughts of their existence in such a place being inconsistent with the manufacturing operations near at hand.

The inspection completed, the members proceeded to the workmen's recreation-room; and here, and in the adjoining kitchen and lavatories, they saw that the Directors had provided with no niggardly hand for the comfort and delectation of the employees. At the entrance to the recreation room, was noticed a new form of incandescent gas-fitting. It is very much after the fashion of, but of course larger than, the electric incandescent bulb. It hangs downwards at an angle, with the mantle suspended at the base. It is now undergoing trial; and it is hoped that further information in regard to it will soon be forthcoming, as it is a distinct departure, and offers the gas manager something really new, in the way of a graceful fitting.

Hospitality of the Directors—Some Current Topics.

In the recreation-room, the Directors entertained their visitors to luncheon of the most generous order. Afterwards,

Mr. R. Hesketh Jones, on behalf of his fellow-Directors, drank to the "Prosperity of the Southern District Association, and to the Health and Happiness of its Members," coupling with the toast the name of the President. In his accompanying remarks, he gave some of the general information that has already been made use of in the early part of this account of the visit. Proceeding he said: We have what is somewhat unusual, two elegant shops—one in Bournemouth, and one at Boscombe; and at both these establishments lectures are occasionally given on the use of gas, especially for culinary purposes. We are subjected to severe competition from our young sister illuminant—the electric light. Notwithstanding this, we exist, and progress. As to the water supply, we can confidently assert that it is second to none on the South Coast. The ever-increasing demand for gas and water taxes the energies of the Company. Our district is a very wide one. As an illustration, I may mention that it will take you at least three-quarters of an hour to drive from the gas-works to the water reservoirs at Alderney, from which you will get extensive views of the surrounding country. Having spoken of the Bournemouth Gas and Water Company, I will ask for your sympathetic regard for our excellent General Manager (Mr. Harold Woodall), who has, during the short time he has been here, won the confidence of his Board of Directors. Before sitting down, I will ask you to permit me to detain you for a few minutes in alluding to Associations of Gas Managers. Yours is, I believe, a flourishing organization; and I wish it, with all my heart, continued prosperity and usefulness. District Associations stimulate exchange of views and the study of all that pertains to the development of the gas industry—exchange of opinions, visits to your neighbours' gas-works, and the friendship between the members cannot be other than beneficial. But I hardly think that two Institutions dividing the gas engineers and managers in England into two camps is desirable. Next month we shall be welcoming the French Société Technique du Gaz to our shores. I shall have the pleasure, as a Director of the Brighton Gas Company, of acting as host on their arrival at Brighton on Monday, July 22; and in the evening of that day I shall again have the pleasure, as the Chairman of the European Gas Company, to unite with the other two Continental Gas Companies—the Imperial and the Union—in inviting the French Gas Managers to an entertainment in London. I believe I am correct in saying that in France there is but one Technical Society in connection with the gas industry; and it would I think, have been better if only one, instead of two, existed in England, so as to have invited their French fellow-workers this year to London in return for their hospitable invitation to Paris last year. Cannot something be suggested to bring together the Gas Institute and the Institution of Gas Engineers? From what one has read of the correspondence recently published, there does not appear to be insurmountable difficulties. The question occurs to me—and I throw out the suggestion for what it is worth—would it not be possible for the Executive of each of the two Institutions to agree to refer their differences to the arbitrament of some gentleman whose official position would command respect—such as the President of the Institution of Civil Engineers—and accept his decision? I am very pleased to tell you that, at the request of an English member of the Société Technique, arrangements have been made by the two Institutions to jointly invite the French Engineers to meet them on Wednesday, July 24. I hope this may tend towards merging the Gas Institute and the Institution of Gas Engineers into one Society. "Union is strength."

These remarks were listened to with considerable attention, showing as they do the interest Mr. Jones takes in the affairs of the industry apart from his directorial work.

The President warmly thanked the Directors for their kindness in receiving the members so cordially, and for allowing them to inspect their admirable gas and water works. In regard to the Association, he rejoiced to know that, as measured by numbers, they were prosperous; and as measured by good fellowship, they were unmistakably successful. He did not know anything more helpful, so far as his observation had gone, than these meetings of the Southern Association; and he regarded as not by any means the least feature of usefulness of District Associations, the visits of inspection which they paid to one another's works. Much was learnt from such inspections; and from the interchange of thought and ideas on occasions like the present. He trusted the success of the Association would be continued for many years.

The toast of the Bournemouth Gas and Water Company was confided to Mr. A. F. Browne, who, in his remarks, described the works as being well up in modern progress. There was, he said, the carburetted water gas, the Sturtevant fan, and the gas furnaces; and though there was no stoking machinery, he believed this was merely due to the fact that structural difficulties were in the way of machines doing all the work they should do. He mentioned this fact with some interest, because both the General Manager and his assistant came from that *alma mater* under whose fostering wing it was still his privilege to work. Both Mr. Harold Woodall and Mr. Head had served under the engineering staff of the South Metropolitan Gas Company; and therefore it was a pleasure to him to meet his old friends. He coupled with the toast the name of Mr. Jones. The toast having been honoured, that gentleman responded; mentioning among other things that he was now an old gas man, having entered into the service of the Dover Gas Company on the 1st of January, 1849.

The next toast was the health of Mr. Harold Woodall, and of him Mr. Helps had many kind things to say. The toast was drank with much heartiness; and, in acknowledging it, Mr. Woodall, with innate courtesy and appreciation, passed upon his Assistant and Works Superintendent encomiums which only merit could have drawn forth.

The Water-Works Visited.

Re-entering the vehicles, the visitors drove first to the Alderney water-works of the Company and then to the Longham pumping-station; but the pleasure of the journey was unfortunately marred by the rain. At the first-named place, they saw filters, with an acreage of 1·64; and storage for raw water equal to 5 million gallons, and for filtered water equal to 4 millions. The sources of the water supply are Longham and Wimborne. At the former place, gravel water is collected from a large area in culverts; the amount being equal to 2 million gallons a day. At the latter place, chalk water is tapped by a well 215 feet deep, and yielding 3 million gallons a day. At Longham, the pumps were examined with interest; information as to their capacity per stroke being given as follows: Turbines, 12 gallons; Nos. 2 and 3 Worthingtons, 51 gallons each; No. 4 beam, 18 gallons; No. 5 beam, 25 gallons—the total being 5 million gallons per 24 hours. Of the general particulars furnished, it may be mentioned that the mileage of water-mains is 87; the number of consumers, 11,155; and the price of water 1s. 6d. per 1000 gallons.

The route taken on the return to Bournemouth from Longham was through scenery which under more favourable conditions would have been charming. On reaching Bournemouth, the President kindly entertained the members at tea in the Quadrant Restaurant. After tea, an immediate departure had to be made by all whose homeward journeys were long; and about 6.30, on the Central Station platform, most of the visitors bid adieu to Mr. Harold Woodall, whose untiring energy had contributed so much to the interest and enjoyment of the day's outing.

WESTERN (U.S.A.) GAS ASSOCIATION.

Annual Meeting at Louisville.

The Twenty-fourth Annual Meeting of this Association was held at Louisville (Ky.), on the 15th, 16th, and 17th ult. The President, Mr. Ira C. Copley, of Aurora (Ill.), occupied the chair.

In the course of his Inaugural Address, the President remarked

that one particular attraction at the city where they were met, was the first practical working of inclined retorts within their territory. The year just passed had been one of unusual prosperity and advancement for the gas industry. The general prosperity had made it possible to secure increased sales; but, apart from this, there was the gradual development of sound ideas in the way of educating the public as to the uses of gas. The near future gave promise of a return to normal prices of materials, and an end of the period of high prices that had been such a trial for the last two years. Another cause for congratulation was that their would-be competitors, acetylene and incandescent electric light, had shown no advance during the year. Electricity was costly; and in every city only a small percentage of the population could afford to look with indifference on an expenditure of several dollars per annum. Nearly half of the electric lights used had not displaced gas-jets. The oldest competitor—the kerosene lamp—still ran gas more closely than any other. At present there was practically no competitor with the gas-cooker; and the gas manager should not rest satisfied until every respectable tenement in his district had adopted one of these appliances. The last few years had seen an enormous growth of a sentiment in favour of municipal ownership of all public utilities; and while he was optimistic enough to believe they had also seen some improvement in the abilities of municipalities, he could not think that the world had yet reached a point where a business could be managed by men having no financial interest in it, with as good results as when managed by those whose very living depended upon the securing of the best obtainable work. The sentiment was a menace to vested interests, as in the event of purchase the present holders might or might not receive the full value of their property; and assuming municipal ownership to be accomplished, it would bring a new element into the lives of responsible gas officials. Engineers would have to study the controlling of votes; and managers or superintendents, instead of devoting their whole time to the details of their profession, must develop acumen to discern the winning element and secure a front seat in the band waggon. Even the labourers would have to see that the cogs of the local machine were well oiled; and all round the municipality would not be so well served as the company. Concluding, he counselled gas undertakings to stand to the principles that their interests were identical with those of the consumers; that their capital was entitled to fair business profits, as no capitalist could be expected to embark in a gas enterprise for the mere rate of interest paid on money advanced on first-class security; and that their business must be honestly managed and the character of their service above the reproach of any fair-minded critic. The capital must represent structural value only; and the profits must not be too large. From a technical standpoint, they must aim at producing as economically as possible; and from a commercial standpoint, they must sell as well and economically as possible. Salvation from the danger of municipal absorption lay with themselves entirely.

Mr. W. E. Steinwedell, of Belleville (Ill.), read a paper entitled "Regenerative Furnaces of To-Day: Directions for Operating and Testing." The various types of furnace in use were briefly described, and the functions of the generator, the combustion chamber, and the recuperator particularized and explained. Coal might be used as fuel; 1360 lbs. of Illinois nut coal being equivalent to 1000 lbs. of Pittsburg coke. But for coal the generator and recuperator flues should be large and of ample area. Plenty of steam should be admitted with the primary air; and more secondary air was required. Coal could not be used until a good working heat was obtained; and even then it might be necessary to go on to coke firing for a few hours in each week, in order to clear away deposits of soot. Before starting, all the metal work should be in good order, and the exterior of the bench clean and air-tight. The brick-work could be painted with a cream of fire-clay and water, if necessary. New benches should be slowly and thoroughly dried, by closing all openings except the main damper and clinkering door, and starting a wood fire. When commencing with coke, the thickness of fuel in the generator ought not to exceed 12 inches at first; and a little air should be admitted through the charging-door. The bed of coke must be kept white hot. These precautions were desirable, in order to avoid risk of explosion of carbon monoxide. When the walls of the combustion chamber showed a red heat, they should fill up the generator with hot, clean coke, seal up the opening with damp breeze, close the charging and clinkering doors, and turn on the primary and secondary air supply, and also the water and steam. Sometimes a hot bar was used to insure the ignition of the furnace gases in the combustion chamber. They should adjust the secondary air supply until short blue flames only were visible at the entrance to the chimney; remembering a slight excess of secondary air was preferable to a deficiency. As the setting heated up, the main damper opening might be reduced until the desired temperature was obtained; and it should in any case be as small as possible. In operating, it was necessary to fire regularly, full, and towards the back, with coke direct from the retorts; keeping the charging door open for as short a period as possible. If cold coke was used, they should fire often enough to prevent the top of the layer in the generator from getting red hot. Clinkering should be done regularly, at intervals of 24 to 48 hours, according to the class of fuel used. The steam supply under the grate should be adjusted to 30 lbs. of water per 100 lbs. of coke consumed; and the furnace door should never be opened while clinkering. To raise the heat, they should first see that the gas and air nostrils were clear, and that the fuel was sufficiently pricked up to allow a free passage of air. Then the primary, secondary, and main dampers should be opened continuously, $\frac{1}{8}$ inch at a time; allowing a sufficient interval between each change. To lower the heat, it was necessary to reduce the openings in a similar manner. The heat below the secondary air inlets should not exceed a dull red; and the draught under the grate bars, above the coke, at the entrance to the recuperator, and at the outlet, should be ascertained and recorded once in each watch. The carbonic oxide canals, combustion chamber, and main outlet should be inspected every few hours. The first-named should never be white hot; and only short blue flames should enter the chimney. Absence of flame showed excess of secondary air; and a long flame, a deficiency. A bright yellow flame was a sign of a leaky retort. The bench might be tested for leaks on the exterior by means of a lighted torch; and there should be an exhaust of about 6-10ths at the last waste-gas flue. A supply of sand and fresh mud, with a shovel, should always be at hand. About 42 inches depth of coke in the generator was sufficient; but perhaps 50 inches was better. When in proper working, the interior of the bench should appear slightly veiled in fog. If perfectly clear, the air supply was excessive; and the presence of flame at this part showed a shortage of air. Carbonic acid determinations should be made once a week. Oechelhaeuser's apparatus for this purpose was easily worked; and the author described it in detail. Two glass vessels are connected by a short neck, and the lower one filled with potash solution. There are three necks in the upper vessel, one closed with a plain stopper, the second with a thermometer stopper, and the third with a stopcock and mercury pressure-gauge. Gas from the flue is aspirated through the upper vessel in the usual way, until a fair sample is secured. The openings are closed, and the whole inverted a few times, then set on a table, and the stopcock opened; and a scale attached to the gauge gives the percentage of carbon dioxide, based on the loss of pressure. If the temperature shows variation during the operation, an appropriate correction can be made. The generator gases should show less than 3 per cent. of carbonic acid; the waste gases 17 to 19 per cent. Less than 17 per cent. might be due either to excess of air or presence of carbonic oxide; and a test for carbonic oxide would determine which. When shutting down, the whole should be closed—doors, damper-slides, and retort-lids—and the air-inlets sealed with clay, and should be allowed to remain so until all visible heat had disappeared. The success of the system turned upon good construction, even distribution of heat, small loss of draught between the grate-bars and the chimney, a minimum of carbonic acid in the generator gases, and a maximum in the chimney gases.

Mr. F. Egner, being asked to open the discussion, highly congratulated the author on the useful and practical character of the paper. It was a clear enunciation of the methods of working regenerative furnaces, and, if followed, would ensure success. He would like to ask how the proportion of steam used was arrived at. Steam was preferable to water under the grate-bars. An important point mentioned was an even depth of fuel, neglect of which caused trouble all round. One advantage of the so-called Munich pattern of furnace was that it facilitated an even depth of fuel. He would have been glad if the author had added something about the best proportions of grate-area and other parts of the generator, respecting which opinions differed. Mr. Norris criticized the carbonic acid apparatus described, and doubted if it would give accurate results. Mr. Somerville thought that ordinary stokers would not look after draughts and carbonic acid testings, and asked if the author employed a superior class of men. Mr. A. E. Forstall said that the working of the furnace was usually left to the foreman, who as a rule could easily grasp the necessary knowledge. He had run regenerator benches for many years without other technical help. The superintendent himself could easily take records of damper openings and other details—a few minutes daily being sufficient; but he thought daily personal supervision was important.

Mr. Steinwedell replied to the discussion and to questions. He admitted that there were a few slight inaccuracies about the carbonic acid apparatus. The use of the lighted torch as a test depended upon the fact that if there was a leakage the flame would "draw" towards it. The sand and mud were intended to be used for stopping cracks as soon as they appeared. The lower middle retort in a bed of six or nine certainly came in for more heat than the others. It should receive a heavier charge; and the best retort in the batch should be selected for that position.

Mr. John Gimper, of Galveston (Texas), read a paper describing the damage done to the Galveston Gas-Works by the memorable storm on Sept. 8 last. The loss was very considerable, and included the destruction of four gasholders, retort-house, shop, warehouse, coal-shed, boundary wall, and dwelling-house, besides meters, services, and mains in the district. The holders ranged from 50 to 80 feet diameter, and were all 18 feet deep. The frames comprised cast-iron columns and lattice girders, without diagonal tie rods. All the holders were upset and collapsed, and left lying in the same direction and angle of repose. In two of the holders the frame was comparatively uninjured. The third was strained sufficiently to put the columns out of plumb and fracture some of the bed-plates; and the horizontals were displaced. In the case of the fourth, every column was snapped off near the base, and the framework scattered in all directions. The inlet and outlet pipes were not damaged. The part of the retort-house above the charging floor, or (say) 10 feet from ground level, was

PREPAYMENT METERS.

CHANGING PRICE.
MOST SIMPLE.
NO WHEELS OR PARTS REQUIRED.

THIS METER CAN BE ALTERED *in situ*.

INSTRUCTIONS.

The Brass Plate has holes around its edge, numbered; these indicate the feet delivered for the Coin used.
To set the Meter, note Figs. I., II., III., IV.

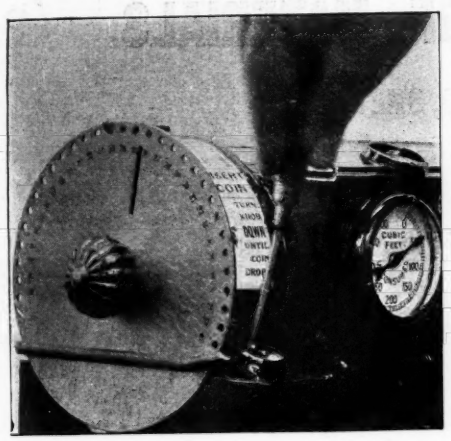


Fig. I.
Break Company's Seal and Remove Screw—THUS.

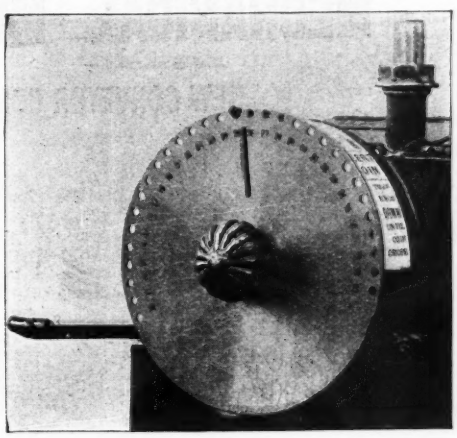


Fig. II.
Swing Band Back—THUS.

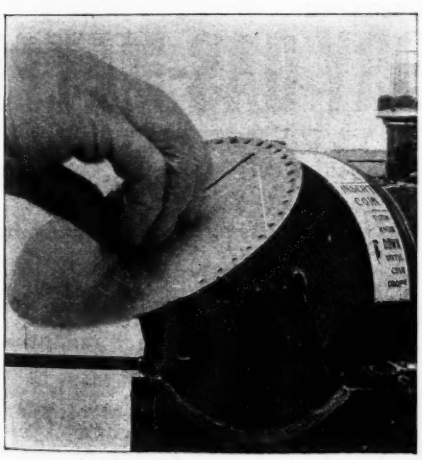


Fig. III.
Lift Plate Off—THUS.

Fig. IV.
Replace Plate—THUS.

Swing Band Forward—Replace Screw—and Re-seal.

NOTHING SO EASY. NOTHING SO ACCURATE.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

BRISTOL:
28, BATH STREET.
Telegraphic Address: "GOTHIC."
Telephone No. 1005.

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "GOTHIC."

MANCHESTER:
37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."
Telephone No. 3198.

GLASGOW:
ARGYLE WORKS, KINNING PARK.
Telegraphic Address: "GASMAIN."
Telephone No. 1525 South Side.

"DOOMED CONVEYORS"

Yes! all doomed by Free Education, and replaced by

LITTLE'S PATENT

MECHANICAL MOVERS OF MATERIALS.

Address:—

NEW CONVEYOR COMPANY, LIMITED, SMETHWICK.

BRADDOCK'S PATENT PENNY-IN-THE-SLOT

(ALSO SHILLING-IN-THE-SLOT)

PREPAYMENT WET AND DRY GAS-METERS

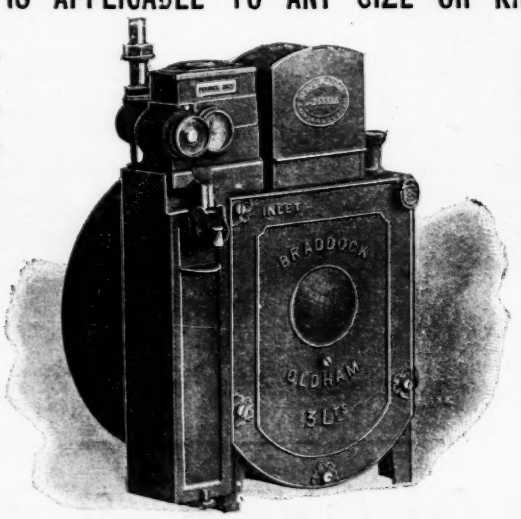
STRONG AND DURABLE. SIMPLE, YET EFFECTIVE.

THE ATTACHMENT IS APPLICABLE TO ANY SIZE OR KIND OF GAS-METERS.

The Attachment is kept as distinct from the Meter as possible, and does not interfere with the ordinary Index of the Meter.

METER REPAIRS ARE NOT COMPLICATED.

NO DELICATE PARTS.



No. 222. BRADDOCK'S CAST-IRON CASE WET PREPAYMENT METER.

By the patent arrangement of Crown Change Wheel and fixed long Pinion, the price may be very readily altered *in situ*.

Any number of Feet per Penny may be allowed.

MOST CONVENIENT AND DEFINITE SYSTEM.

NO FINE WHEELS.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 248 HOP.

completely destroyed, as also the chimneys; but the benches themselves suffered comparatively little harm. The connections from the hydraulic to the exhauster-room were broken to pieces; and the buildings above mentioned were blown into an indescribable mass of ruins—large portions being carried away altogether, while parts of structures from surrounding property were thrown on to the site. The loss and damage to the distributing plant and meters was scarcely yet known; but so far it appeared the mains had escaped fairly well. The whole were flooded with salt water, which entered the mains at the works and drove the gas before it. Several consumers thus obtained a supply of gas hours after the holders were destroyed; and he heard that one was able to prepare breakfast at the gas-stove as usual on the following morning. The storm came on suddenly after dark. The noise was terrible—wind, water, and everything seeming to be in the highest state of commotion. The wind-force appeared to be of a bounding up-and-down motion; and he thought it lifted the holders out of water in the first place, got underneath, and careened them over, the highest side being in all cases towards the direction of the wind—the south-east. Considerable tracts of land were washed away, and there was a permanent encroachment of the sea; so that some of his mains were now under water.

The consumers pressed eagerly for a renewal of the gas supply; and this was commenced on Oct. 18, after 39 days' interruption. Getting into working order was no small matter; the works being loaded with promiscuous ruins, service-pipes broken at every wrecked house, and the 27 miles of mains full of salt water. Everything was covered with slimy mud; labour at once became scarce and expensive; and the three railway bridges being destroyed made it impossible to get materials delivered from outside. About 21 days of the delay in recommencing were lost in waiting for lifting cables, &c. The first thing was to get the holders right; and he managed to repair the smallest with materials and tools on the site. A second holder was then got in order, with no trouble beyond the delay just mentioned. A third holder was being replaced with a new one; and the fourth still remained a wreck. The clearance of the mains was a troublesome matter owing to the level nature of the district, which necessitated no less than 235 syphons. He ran a steam-pump at the works as long as possible, and then cleared the syphons one by one with hand-pumps. He lost no time in repairing broken services; but some were not discovered until located by leakage of gas.

(*To be continued.*)

A DOUBLE-STANDARD PHOTOMETER AND A CALORIMETER DEVELOPMENT.

Among the evidences of advances recently made in the realms of science which were collected together at the Institution of Civil Engineers on the occasion of their *Conversazione* last Wednesday were two which were centres of interest to many of the brilliant company assembled. They were a "Double-Standard" photometer, and a development of calorimeter, about both of which there are points showing that the designers (Messrs. Simmance and Abady) have a very clear perception of the practical requirements of the day in regard both to the measurement of light and heat.

To deal with the "Double-Standard" photometer first. The strides which have been made in high-power gas lighting have brought with them the necessity for a photometer capable of testing lights of intensity. A recognition of the difficulty of working with a moveable disc-box and a fixed standard, and yet ensuring the proper angle of disc presentation, and also of comparing (in a limited space) with the hitherto available standards of light a light of high power, has resulted in this early production of an instrument suitable for the purpose. An inspection of the one on view at the Institution of Civil Engineers—which only occupied the space of a 60-inch Letheby-Bunsen photometer—made it clear to us that, by its use, lights of from 1 up to (we think we might say) 10,000 candle power can be accurately measured horizontally or at any angle. In the one seen, the primary standard is a Harcourt 10-candle pentane lamp, the secondary standard a No. 4 Kern burner, and the lamp under test a powerful electric arc. A very special part of the photometer is the disc-box, which contains, in addition to the ordinary bunsen disc, an angle mirror, by which the light can be brought into the field of vision, and its actual angle and distance from the disc ascertained by a quadrant with pointer.

The following description explains the instrument and its method of manipulation: The instrument is mounted on a strong table, which is ebonized and polished. The bars are to a 60-inch scale; the direct reading to be multiplied by the power of the standard. There are two standards, primary and secondary—the former a pentane standard of 1 or 10 candles, while the secondary can be of any power required, and its power is variable. The revolving sextant disc-box can be fixed at one point, and the secondary standard moved; or, for horizontal readings, the secondary standard can be fixed at its marked position, and the disc-box moved The disc-box between the two standards is used as ordinarily. The directions for use are: Light the pentane standard and the secondary standard, which latter may be of any description—a "midget" arc lamp, a filament incandescent lamp, a Welsbach, or an argand burner. Fix the light under test in any convenient position, and at any convenient height, and fix the secondary standard at its mark and the revolving disc-box at the other end of the bar. The operator stands at the small end of the bench, and glancing along the secondary bar (the longer one) moves the photometer until in a line with the light under test. Then the sextant mirror is fitted in the revolving disc-box, and turned until the light under test shows in the mirror at the intersection of the lines. Read the lower pointer angle. (Say this is 30°.) Then move the upper pointer till it indicates 30° on the upper scale (thus bisecting the angle of the light from the horizontal, and presenting an equal angle to both lights). The sextant mirror can now be removed, and the disc-holder inserted. Ascertain on the primary bar the actual power of the secondary standard. (Say the reading is 6·5 with a 10-candle standard, the power is then 65 candles.) Turn to the secondary bar, and move up the secondary standard until the disc is equally illuminated. The long moving scale on the secondary standard will give its distance from the revolving disc-box at a glance. (Say this distance is 16·5 inches.) Measure from the revolving disc centre to the perpendicular of the light under test. (Say 125 inches.) Turn to the table of angles for the constant for 30° = 1·3, by which multiply the square of 125 inches = 20312·50. *This is the square of the hypotenuse of the right-angled triangle formed by the perpendicular to the light, the measured base line, and a line from the disc to the light.* Therefore the distance of the standard being 16·5 inches from the disc, this number squared (=272·25), divided into the 20312·5, gives 74·6, which, multiplied by the reading on the primary bar (viz., 65 candles) gives the result of 4849 candles. This is the actual illuminating power of the light under test.

The table of constants or multipliers for different angles (which table forms part of the Appendix to the new edition of Abady's "Hartley's Gas Manual") is based on the following formula:—

$$AB^2 = AC^2 + (AC \tan A)^2,$$

where AC is the distance from the disc to the light under test, and A the angle observed by the sextant mirror of the disc-box. The use of the table in the manner described above obviates the measurements of perpendiculars, angles, or hypotenuse.

This photometer is in practical use by one of the London Gas Companies, and others are in course of construction. The one we saw has been constructed by the manufacturers (Messrs. Alex. Wright and Co., Limited) for the Great Western Railway; and in all its details and finish, the instrument leaves nothing which the most fastidious could desire.

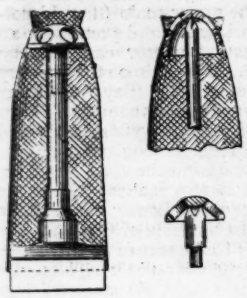
Now we come to the new development of the Simmance-Abady calorimeter, which was also on view at the Institution of Civil Engineers. Daily evidence is springing up—for instance, quite recently we were informed by a gas manager that nearly one-third of his make of gas (his works are situated in a small manufacturing centre) is used for motive power—that a new gauge of quality or standard of working in the manufacture of gas is becoming, if it has not already become, an absolute necessity. So long as gas was almost entirely used for its illuminating power, calorific value could, with some show of reason, be practically neglected, and even the enormous strides in the direction of cooking by gas scarcely affected the question. It is, however, obvious that in future "calories" will rank as "candles;" and the users of explosion engines will look as narrowly at the B.T.U. as the London County Council (shall we say?) at present look at tenths of a candle. This being so, any step towards reducing calorimetry from its hitherto nebulous condition to a concrete form, and rendering the rapid and accurate estimation of calorific value a thing easy to attain, is to be treated with serious consideration.

The importance of the development which Messrs. Simmance and Abady have effected in their calorimeter will be perceived from the following description: It may be taken as ceartin that to correctly estimate the calorific value of gaseous or liquid fuels, uniformity of initial temperature of fuel, water, and atmosphere must be ensured. No one but the experimentalist knows how difficult it is to arrive at this condition. Messrs. Simmance and Abady claim, however, that, with their apparatus, these *desiderata* are attainable. Further (and this will appeal to many gas-works managers), the apparatus is self-contained, and requires no permanent water service. A cistern of 10 gallons capacity is elevated on a stand; and this receptacle is a Mariotte bottle on a large scale. Thus an artificial atmosphere ensures constancy of water flow, which water passing through the calorimeter is received in a tank beneath the table on which the instrument stands. To this tank is attached a small semi-rotary lift pump, by which the water is returned to the upper tank, and is used over and over again. The readings of the calorimeter are made at intervals of about one minute; and three readings constitute a test. An experimental meter and governor are provided to measure and regulate the gas supply, which is automatically shut off when the upper cistern is emptied. An adjusting valve and delicate thermometer are arranged at the products outlet; and it will thus be seen that the water will be at atmospheric temperature both in the tank and in the meter, and by the regulation of the products outlet, absolute uniformity throughout is obtained. Wherever a supply of the gas to be tested is obtainable, the instrument can be used, and the absence of all permanent connections for gas, water, or waste, affords portability. The apparatus is made by Messrs. Simmance and Abady at Messrs. Alex. Wright and Co.'s works, at Westminster. As in the case of the photometer, we can speak highly of its general appearance; and its utility, we have no fear, will be found equally effective.

REGISTER OF PATENTS.

Incandescent Mantle Supports.—Sugg, W. T., of Westminster. No. 13,147; July 20, 1900.

The object aimed at by the patentee is to always carry the mantle at the proper height to obtain the best results. In the course of many experiments, he has found that the illuminating power varies according to the length of the mantle and the pressure of the gas; and that no two mantles are alike—that the length of the supporting loop of asbestos fibre varies often as much as ¼ inch, with the result that the mantle is lowered to that extent, and the effective illuminating surface is reduced.



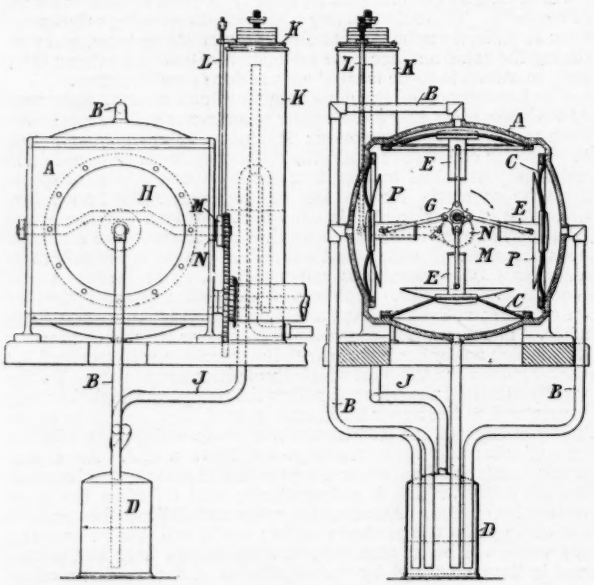
The means he suggests for supporting the mantle irrespective of the loop, are such that, having once fixed the ratio between the length of mantle and the pressure of the gas, the effective surface of the mantle will always remain the same.

As shown, the usual peg is fixed into a socket capable of being fitted on a stump of the burner; and on the top of the peg is attached a 'mushroom' of steatite, which will support the mantle by its rounded top. In the top of the mushroom, several holes of suitable size are made, which allow an outlet for the gases of combustion. The mantle is thus supported by its smaller end all round, and not by the loop.

Compressing Gas and Air.—Gore, J., of Dublin. No. 11,268; June 21, 1900.

This invention relates to apparatus by means of which gas or air can be compressed and delivered continuously at a practically uniform pressure, as shown in the engravings—a side elevation of the compressing apparatus connected in series with a carburettor and a gasholder (adapted for the production and storage of an inflammable mixture of air and hydrocarbon vapour, the production being regulated by the vertical movements of the gasholder), and a section at right angles to the outside view.

The metal casing A has gas outlet-pipes B, and four pulsating diaphragms C secured along its outer edge, and all discharging below the surface of the liquid in the carburettor D. To each diaphragm is connected a valve-casing E, between which and the diaphragm is a metallic backing-piece or support P, which roughly conforms to the shape of the interior face of the casing A, so as to hold the diaphragm snugly thereto when in the closed position. The supporting-piece P is secured with the valve-casing E to the diaphragm. The valve-casing has a way through it, and a valve-seating on which rests a valve connected to one corner of a four-pointed star-shaped plate G loose on the pin of a crank-shaft H driven by any suitable power. The four points of the plate G are located 90° apart; so that the rotation of the crank-shaft effects the successive reciprocation of the four connecting-rods and the connected diaphragms C. The valve-casing contains a spring, which bears at one end on the valve-casing and at the other end against the valve, so that, on the backward stroke, the valve is removed from its seat before the diaphragm is drawn out by the casing, thereby allowing the air to pass through the valve-way and fill the space between the diaphragm and the outer metal casing.



Each outlet-pipe B may be fitted with an ordinary non-return valve; but preferably the outlet-pipes of two pairs of pulsating diaphragm compressors are connected, as before stated, to a reservoir D containing a carburetting liquid, below which the compressed gas or air is discharged, and which thus acts as a liquid non-return valve. From this carburetting reservoir D, a pipe J leads the gas or air or carburetted mixture to the gasholder K, or to any desired locality, at a practically uniform pressure. The holder, where one is used, is fitted with a vertically rising bell of the ordinary kind, to which a rod L is connected, the lower end of which is pivoted to a lever fitted with a band-brake M, acting upon a brake wheel N on the crank-shaft H or other motive shaft, so as to stop the action of the compressing apparatus when the gasholder reaches a predetermined height.

Liquid-Meters.—Barr, J., of Kilmarnock, N.B. No. 8053; April 19, 1901.

In carrying out this invention, the meter (arranged in a casing) comprises a number of curved vanes or blades carried by a disc or drum on an axle centred in the casing. The liquid to be measured is admitted by a pipe passing through the casing, which is filled with mercury to a height a little below the inlet-end of the pipe. The vanes are so curved that, when one end of each comes in turn above the mercury, the liquid acts on it in such a manner as to cause the disc or drum to rotate in the desired direction; and each vane coming into action in succession continues the motion—the liquid escaping to the discharge-outlet from the casing as the rising end of the vane preceding the one being acted on ascends clear of the mercury. The mercury thus acts as valves to permit of this consecutive action of the liquid on the vanes taking place. The motion of the drum is transmitted in any suitable way, as, for example, by a worm on the axle of the disc or drum which drives a worm-wheel on a spindle, which, in turn, actuates counting mechanism of any desired construction.

Fig. 1.

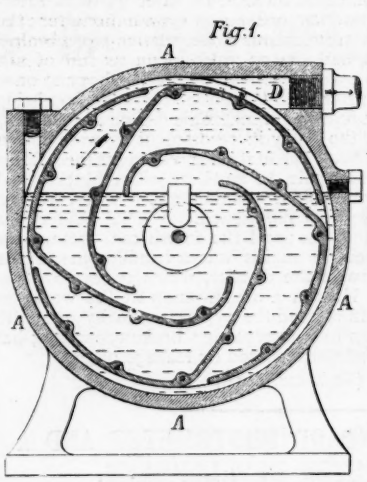


Fig. 2.

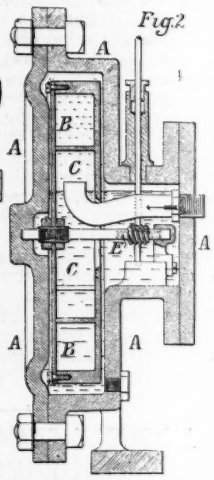
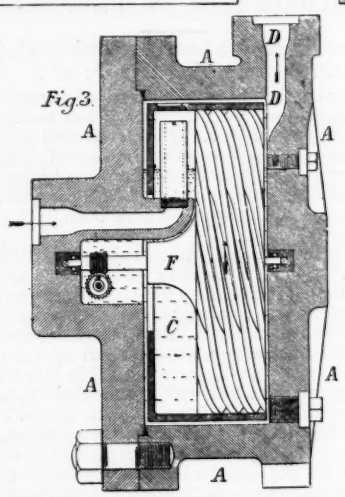


Fig. 3.



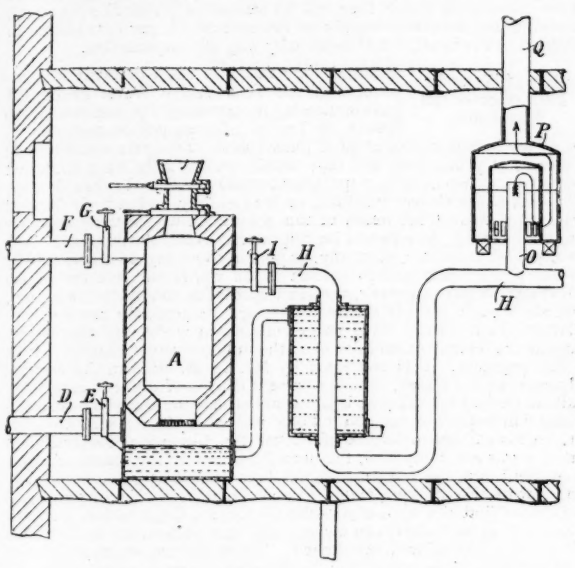
As shown in figs. 1 and 2, there is provided a casing A, in which there are a number of vanes or blades formed on, or fixed to, one side of a disc; a second disc B being secured to the other side of the vanes, so that there is formed a drum C, of a diameter little less than the internal diameter of the casing A, and capable of turning on a horizontal axle centred in the casing. The casing and drum are filled with mercury to a height a little above the middle. The liquid to be measured is admitted to the interior of the drum by a pipe led through the casing, and through a central opening in the disc; the end of the pipe being bent upwards so that the inner end is above the level of the mercury in the drum. When the forward end of each vane has in turn passed over the inner end of the liquid admission-pipe, and just entered the mercury, a space is enclosed. The liquid under pressure rises in this space and presses on the underside of the vane; and the drum is made to rotate in the direction shown by the arrow. Each vane coming into action in succession continues the rotation of the drum, and the liquid escapes to the discharge-outlet D from the casing as the rising end of the vane preceding the one being acted on is lifted clear of the mercury. A worm on the horizontal axle of the drum drives a worm-wheel E, on a spindle which passes to the outside of the casing, and actuates counting mechanism of any suitable construction.

As shown in fig. 3, the drum C consists of a central boss F, of considerable size, and an outer shell with an annular disc, through which passes the inlet for the liquid under pressure. The vanes or blades are in the form of "a plural-threaded screw" (in this case four blades

being shown) carried between the boss F and the outer shell to one side of the inlet. When the forward end of each blade rises above the mercury, the liquid gets access to the space between it and the next succeeding blade, and, owing to the shape of the blades, the pressure of the liquid causes the drum to rotate in the direction of the arrow—the rotation being kept up by the forward ends of the blades coming in turn above the mercury. The arrangement of the blades and mercury is such that there is never a clear passage from one end of the drum to the other. The liquid escapes to the outlet D as the rear end of the blade preceding the one being acted on is lifted clear of the mercury.

Gas Generators.—Gerdes, H., of Berlin. No. 13,205; July 21, 1900.

This invention relates to generators for use in connection with gas-engines, so as to provide apparatus for use beneath living-rooms or large warehouses where it is undesirable or impossible to instal steam-generators. The plant operates in the ordinary manner—that is to say, the generator is actuated by the sucking action of the gas-engine, thus rendering a gasholder unnecessary.



The generator A is fitted at its upper end with a charging hopper furnished with two slides, with a suitable measuring space between them. From the lower part of the generator a pipe D, fitted with a valve E, leads to the exterior, and supplies the air for combustion. The upper part is in communication with the exterior through a pipe F fitted with a valve G, through which the gases from the generator can be conducted to the exterior when required during stoppages or on the generator becoming heated. The pipe H and valve I for supplying the gas produced in the generator to the gas-engine are furnished with a cold-water condenser. The water surrounding the condenser (as it becomes heated) is "utilized in the generator for producing explosive gas." To the rear of the refrigerator the pipe H is provided with a branch-pipe O, leading into a safety device, consisting of a closed vessel P, partly filled with water, and fitted with an outlet-pipe Q. In the interior of the vessel there is a bell open at the bottom, and having openings also at the lower end. "This arrangement enables the gas, during an accidental occurrence of over-pressure in the conduit, to escape into the atmosphere."

APPLICATIONS FOR LETTERS PATENT.

11,804.—Smith, G., "Acetylene gas machine." June 10.
11,810.—Alexander, W., "Wet meters." June 10.
11,825.—Chandler, S. S. & S. B., "Gas-purifying apparatus." June 10.
11,828.—Martin, W. J., "Obtaining high-pressure gas." June 10.
11,835.—Bonsor, H., "Gas-fires." June 10.
11,903.—Seifert, C. M., "Gas and air heaters for burners." June 11.
11,908.—Rainey, C., and Banbury, J., "Internal combustion engines." June 11.
11,916.—Nicholson, V. R., "Internal combustion engines." June 11.
11,935.—Beaven, E. S., "Cleansing of gases." June 11.
11,958.—Macrill, F., "Internal combustion engines." June 12.
11,981.—Rosenthal, S. A., "Burners." June 12.
12,063.—Cliff, W. D., and Sugden, F. C., "Conveyors." June 13.
12,064.—Collis, A. B., "Gas and oil engines." June 13.
12,093.—Hemingway, H. W., "Separation of sulphuretted hydrogen from gas." June 13.
12,126.—Hodges, J., "Gas-stoves." June 14.
12,127.—Wilson, J., "Gas-burners." June 14.
12,137.—Wilson, J., "Incandescent mantles." June 14.
12,148.—Ingham, W., and Owen, J. H., "Conveyors for coal and coke." June 14.
12,204.—Toedt, F. W., "Gas-engines." June 14.
12,259.—Brett, C. G., and Henneberger, F., "Incandescent gas-lamps." June 15.

At an extraordinary general meeting of the proprietors of the Rhymney Gas Company, Limited, recently held at the Gas-Works Office, Pontlottyn, Glamorganshire, it was resolved that the Company be wound up voluntarily.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Optimism and Pessimism as Tangible Business Factors.

Sir,—I notice in your issues of the 11th and 18th inst., an article on the above from the pen of Mr. Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S., in which that gentleman refers to a paper which I recently read before the Institution of Gas Engineers.

With reference to the title of my paper, I may say that it does not allude to the American publication Mr. Humphrys mentioned, nor was it copied from that paper. It simply referred to the rapid strides now made by science, in the present day, which is surely a "Progressive Age" in the scientific world generally.

Then Mr. Humphrys refers to a paper read by Mr. C. R. Faben, of Toledo, in which that gentleman approves of taking an optimistic view of one's own business, and believes in placing his own goods with an overwhelming spirit before the whole world. To a certain extent, it is quite advisable to follow such good advice. At the same time, there are periods when competition is so keen that one reflects back for solving new methods to compete against all comers. It does not always do to postpone the introduction of improvements into the market; for, by so doing, one is inclined to be late in the field of success.

As to "pushing slot-meters and cooking-stoves for all they are worth," I should say push everything imaginable that will introduce the use of gas, and increase its consumption.

The "nine days' wonder" which the author refers to, cannot be accepted by all; although I do not think that consumers who have adopted the use of electricity in preference to gas would recommend it to their friends, unless they wished them to be "bit" by the same "dog"—that is, in paying more for their artificial lighting. At the same time, people do not care to have their property destroyed by first trying one system of lighting and then another; so, by offering vast inducements to our consumers, and educating them to modern methods of lighting, so as to prevent rivals making headway, my proposal is the only way which I can see to overcome the same.

As to my proposal of reducing the illuminating power of gas, it is sufficient to indicate a method of fighting against the competition of rivals. Reducing the quality of gas means a saving of over 2d. per candle per 1000 cubic feet of gas made, which is a considerable item. This statement can be supported by the recent reduction in the illuminating power of the gas to be supplied by the South Metropolitan Gas Company; and by the adoption of a cheaper gas, it will undoubtedly lead to a further growth of their business.

As to the remarks made by the author about freights on low or high priced coal, that is all very well in its way; but imagine a saving of 5s. per ton by using a low-class coal over a higher grade. Such an enormous difference would have been the salvation to many during the past year or so; for 5s. per ton saved is 5s. gained, and means the backbone of success in meeting competition with cheap gas.

A remark was made at the Institute meeting that gas should be produced at its natural illuminating power. Such a suggestion, if adopted, would lead to considerable difficulty and trouble—more especially with those who use twenty or thirty different classes of coal. Each time a fresh brand of coal came to be carbonized, a different quality of gas would be produced; and then disputes would arise between the public gas tester and the manager, and would tend to complicate matters very much. The suggestion seemed to me as unpractical as the following is absurd—that either a written notice would have to be sent to the gas tester in question, that there was about to be a change in the coal carbonized, and that the quality would be either higher or lower as the case may be, or the town crier must be sent round to inform consumers that the quality would possibly be a quarter-of-a-candle higher on that particular day. On the other hand, with a very low-quality gas, one would be perfectly free from all liability, owing to the large margin that would be retained. Not that for a moment one would send out absolutely a 10-candle gas, but would carry a large factor of safety—say, of 1 candle or even more—and would be really no worse than what is reputed in some remote districts.

By the adoption of a low-quality gas, the high-pressure system of gas lighting could be more freely used. It would not matter even if there was a little extra leakage from the additional pressure, when such a considerable reduction in the price of gas could be made. Its use would entirely supersede electricity. If this method was not adopted, the low-pressure intensifying system could be used as an alternative.

Without hesitation, the writer does not know of an industry that can meet competition so successfully as our own; but we must go with the times, for very often delays are dangerous.

The day is not far distant when the flat-flame burner will be a thing of the past. This is more apparent on the Continent. The foregoing remarks are by no means a prophecy. The general adoption of the incandescent burner on the Continent will no doubt be followed in England in course of time. But, unfortunately for our nation, we are certainly very slow in moving; and I am afraid our industry has got into the same sluggish way.

Such superior incandescent gas lighting as may be seen all over the Continent certainly checks the progress of electricity; and the golden example set by our Continental friends should certainly be more adhered to than is the case in England at present.

In conclusion, it is not a question of "throwing up the sponge," as suggested by Mr. Humphrys; but surely where there is a weak point discovered, there is no time like the present for the remedy, and nipping the young flower in the bud.

J. D. Ashworth.

Portsmouth, June 21, 1901.

At the meeting last week of the Bingley District Council, the question of acquiring the Wilsden portion of the Clayton, Allerton, and Thornton Gas Company's area of supply, in the event of the works being purchased by the Bradford Corporation, was left in the hands of a small Committee of three members.

PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOMS.

The Electrolytic Contest. The present parliamentary session will be famous in respect of gas and water matters for the persevering struggle which the Metropolitan Gas and Water Companies are making to get protection for their distributing systems against injury by straying electric currents and a right to satisfaction for mischief done. As recently pointed out in "Gleanings," there has hitherto been no consistency in the decisions of Committees when the question has been raised in connection with Bills dealing with electric tram and railways. Naturally, nearly the whole of the electrical profession are in opposition to the gas and water interests over the point, although professing that electricity is the most innocent and tractable of creatures. The only manner therefore in which gas and water undertakers will procure a generally recognized means of defence is by continuing to peg away on every occasion that presents itself. But the longer they are kept from securing what is their just due, the worse it will be for those who have big electric traction systems put down in their midst. The fight has been carried to an acute stage over the London United Tramways Bill before Sir John Kennaway's Committee. Since the Bexley Tramways Bill was in Committee, important fresh evidence has been gathered by those eminent electricians who have steadfastly held that further protection should be afforded to gas and water suppliers. Sir John and his colleagues have had much scientific evidence poured into their ears by the promoters of the London United Bill for the purpose of showing that the existing Board of Trade regulations are sufficient; and yet the promoters of the Bill resist the insertion of even such a clause as that obtained by the Sheffield Gas Company! One of the witnesses asserted that any clause similar to the Sheffield one would have a serious effect on the tramway enterprise in this country. The plain man naturally asks, Why? if the tramway systems are laid in conformity with the conditions of those so-called adequate prescriptions of the Board of Trade. In the evidence for the promoters there was also an introduction of simple remedies for the prevention of harm—one being that by making near the generating station a good copper bond connection with the gas or water pipe the escaped current would be carried back to the station. Granting that this or any other of the suggested remedies is efficient, the question again arises, then why refuse gas and water suppliers the clauses they ask for? Sir William Preece thinks the regulations are sufficient, but that the Board of Trade wants strengthening in their inspecting department in order to see that the regulations are carried out. This surely is a damaging admission, and contains beneath it ample reason for Parliament vouchsafing to gas and water suppliers the more stringent protection which they desire. Before the promoters' case was concluded, the petitioners were encouraged by one or two remarks which the Chairman let fall. Is it not a fact, he asked, that we want these regulations strengthened? And, again, he thought the Committee had it clearly before them how possibly danger might arise. The whole of the evidence of Professor Ayrton for the petitioners, was particularly edifying to gas and water engineers. It is manifest from what he says that there is nothing in the Board of Trade regulations which will prevent electric currents being sent through pipes; and no change in the regulations will give absolute protection except insulation. Experiments and investigations have proved to him conclusively that the currents which escape into pipes are much larger than the tramway companies are aware of; and he gave figures which, we fancy, will cause them no little amazement, and perhaps uneasiness.

[Any hopes the petitioners may have entertained owing to the remarks of Sir John Kennaway last week were wrecked yesterday afternoon. Just as the "JOURNAL" was going to press, the Committee found that the preamble of the Bill was found proved in regard to clause 12. The effect of this is to refuse the petitioners further protection than the Bill already affords.]

It may be of interest to mention here that, in the case of the Chester Tramways Bill, the gas and water companies petitioned for the insertion of a clause on the lines of the Sheffield one; but the Corporation have agreed with them that, if the result of the present session be to show that Parliament considers such a clause should be incorporated in Electric Tramway Bills, then the Corporation will place themselves under a like obligation, just as if the clause had been originally included in their Act.

Stockport's Water Scheme Endorsed by the Lords. The Stockport Corporation have proved to a Committee presided over by Lord Pirbright the expediency of undertaking the construction of additional water-works in order to be prepared to satisfy the growing demands of the inhabitants within the limits of their supply. The Bill which encompasses the scheme proposes the construction at Kinder of a stone reservoir in the parish of Hayfield, and a conduit to Disley, through New Mills and Newton. At Disley a service reservoir is contemplated; and from it pipe-lines are to be laid through several districts to a service reservoir at Alderley. At Disley a pumping-station and tank are component parts of the project; and other reservoirs are planned for construction on the River Sett in the parish of Hayfield and at Hollingworth Clough, where provision is made for a conduit to the Kinder reservoir. The computations as to the cost of the scheme run to, in round figures, £810,000. Upon such a large outlay, the ratepayers, it will be remembered, did not look at all complacently when the scheme was first mooted; but perhaps its endorsement by Lord Pirbright's Committee will allay their fears and objections. Much opposition was withdrawn before the Bill reached the Committee by the granting of protective clauses; but this did not prevent the absorption of some half-dozen sittings by the cases for the measure and the remaining hostile parties. Millowners desired to obtain more than the Corporation felt willing to grant; the district of Hayfield wished to make its future supply certain and cheap; and the Heaton Norris District Council asked that within the next few years they should be allowed to exercise the option given under the existing Act of purchasing the portion of the water undertaking in their district, the price not to be enhanced in respect of the cost of any part of the new works that may then have been carried out. There were a number of witnesses for the Bill; but the principal evidence was tendered by the propounder of the scheme, Mr. James Mansergh. It was made abundantly plain by him that there is a question of urgency about the scheme, seeing that it will take the Manager all his time to conserve the present supply so as to make it last out until the new works are sufficiently far advanced to come to his aid. The catchment area extends to some 4560 acres; and the yield of water is estimated at 4¼ million gallons a day. Mr. H. Rofe and Mr. G. F. Deacon supported the case presented by Mr. Mansergh on behalf of his project. The Committee gave a full and fair hearing to the opponents; but, in the result, they found the preamble proved. They refused the clause requested by Heaton Norris. But they gave to the inhabitants of Little Hayfield the right to retain their present supply of water free; and with regard to Hayfield itself a quantity up to 100,000 gallons a day is to be supplied at cost price. It was stated in a discussion that followed the announcement of the Committee, that terms had been arranged with the Calico Printers' Association (who own several works in the district) by which they will be treated as favoured consumers, receiving any necessary supply at the rate of 1d. per 1000 gallons in addition to the usual free allowance by way of compensation.

Sale of Water in Bulk Outside the Tees Valley. Although they failed in the Commons, the opponents of the Tees Valley Water Board Bill have succeeded in upsetting the measure in the House of Lords. Its proposals appeared to be of an innocent character if placed under adequate conditions in the way of protection, and they would undoubtedly have conferred benefit on a considerable population outside the Board's own district. The idea of the Board was that, so long as they had at their disposal water in excess of the needs of the population within their statutory limits of supply, they should be empowered to sell the surplus in bulk to any local authority, company, or person requiring a supply, subject to the preservation and protection of the rights and interests of the Cleveland Water Company, the Hartlepool Gas and Water Company, and the South Shields Water Company. It certainly seems a pity that the Board should have water running to waste, and that people outside the district should not have the opportunity of obtaining it at a fair payment. It is estimated by Mr. D. B. Wilson, the General Manager of the Board, that the present margin of water is 21,250,000 gallons per week. Of this, it is estimated that the Board's own population will require 10,000,000 gallons, which would leave an available 11,250,000 gallons to dispose of. After the Grasholme reservoir and other works are completed, the quantity of water the Board will take from the Lune, the Balder, and the Tees will be 194,568,000 gallons; and out of this it is estimated there will be a margin of 94,568,000 gallons. That the opponents—the Darlington Corporation, the Tees Salmon Fishery Board, and owners and occupiers on the banks of the Tees—would be injured was denied. The arguments were put forward that the Bill was an attempt to do something in opposition to the principles of parliamentary practice; that the Tees would be detrimentally affected; and that water ought not to be taken out of the Tees Valley, but should be conserved for the population in the district. Just as well might it be argued that Liverpool and Birmingham ought not to have been allowed to abstract water from Wales for their thirsty populations. However, their Lordships were unable to approve of the Tees Bill, excepting so far as it referred to the supply of a firm at Redcar.

Local Obstructors, and Waste in Futile Opposition. The South Staffordshire Water Company have a large district to supply, and to boot a difficult one to serve. But by the careful direction of the Board and a strict surveillance by Mr. H. Ashton Hill, their Engineer, the Company have performed their duty in a manner which should under the circumstances give, if it has not always given, satisfaction to the consumers. In their persistent endeavour to keep themselves abreast of requirements, new work is constantly in hand; and among their latest undertakings are two wells at Hinksford and Ashwood in the district of Kingswinford. For the purpose of obtaining the necessary capital (to the extent in all of £375,000) for facilitating the pumping operations at these wells and for other objects, the Company applied to the Board of Trade this session for a Provisional Order; and it was in due course included in the Water Orders Confirmation (No. 1) Bill. This was brought before a Select Committee presided over by Lord Harris last Wednesday, when the Local Authorities of Kingswinford took the opportunity of trying to override the decision of the Board of Trade by asking that they should have special treatment in the matter of the water supply of the Wallheath portion of their district, and that the Company should in respect of the supply of that place forego the payment of 10 per cent., which, under the general law, they are entitled to from the Kingswinford Rural District Council. It was shown by the Company's witnesses that the district in question could not be injuriously affected by their operations; and, without hearing the opponents, the Committee came to the unanimous opinion that no case had been made out in cross-examination for exceptional treatment. Counsel for the petitioners thereupon withdrew, but threatened continued opposition in the Lower House

Protecting Riparian Owners at Prestatyn. The agreements arrived at when the Prestatyn Water Bill was before the House of Lords did not safeguard the measure from further opposition when it reached the Commons. It may be recollected that by the Bill the District Council seek power to acquire the undertaking of the Dyserth and Prestatyn Water Company, of which the sole proprietor is Mrs. M'Laren, the wife of Mr. Charles M'Laren, M.P. In the House of Lords, Mrs. M'Laren opposed; but an arrangement was effected whereby she agreed to part with all her rights and responsibilities of supply for £7750. The source of the supply is the Flynnon Asaph stream; and certain riparian owners also objected in order to gain protection. All were satisfied excepting a Mrs. Conway, who claimed that the promoters ought to be placed under an obligation to maintain the minimum summer flow of the stream at such a level as would prevent her property from being deteriorated. The matter was argued last week before a Committee presided over by Sir John Brunner; and the end was an expression

of willingness on the part of Mrs. Conway to come under the protective clauses granted to the other owners if she were entitled to proceed against the District Council for penalties if the gauges which measure the flow of the stream are not properly kept. The Committee saw no objection to this; and the necessary clause was therefore incorporated in the Bill. Accordingly the preamble was declared proved.

Rhyl Water Bill. A Committee of the House of Commons have disposed of the Rhyl District Council Bill, which is to enable them to carry out certain improvements, including an additional water storage reservoir. The Local Authority supply not only Rhyl, but certain outside districts. These have hitherto paid 23½ per cent. of the water expenses; the urban district bearing the remaining 76½ per cent. The estimated expenditure on the new works is £20,000; and by the Bill it was proposed that the urban district should contribute 75 per cent. of this amount and the outside districts the other 25 per cent. The outside districts could not see why there should be any alteration in the percentage, and so they opposed. The Committee agreed with them, and, with the necessary amendment, passed the preamble.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Blackburn Corporation Bill, Wallasey Improvement Bill.

Bills read a second time and committed: Bradford Corporation Bill, Bury Corporation Bill, Dorking Gas Bill, Mond Gas Bill, South Metropolitan Gas Bill.

Bills reported: British Gaslight Company Bill, Horley District Gas Bill, Stroud Gas Bill, Water Orders Confirmation Bill (No. 1), West Surrey Water Bill.

Bills reported, with amendments: Derwent Valley Water Board Bill, Harrogate Water Bill, Richmond Gas Bill, Ripon Corporation Bill, Rugby Water and Improvement Bill, Salford Corporation Bill, Stockport Corporation Water Bill, Stratton and Bude Improvement Bill, Tendring Hundred Water Bill.

Bills read the third time and passed: Harrogate Water Bill, Horley District Gas Bill, Leatherhead Gas Bill, Newport (Isle of Wight) Gas Bill, Ripon Corporation Bill, Smethwick Corporation Bill, Stratton and Bude Improvement Bill.

The Aldershot Gas and Water Bill and the Llandrindod Wells Urban District Council Water Bill have been referred to a Select Committee, consisting of Lord Brougham and Vaux, the Earl of Shaftesbury, Lord Manners, Lord Abinger, and Lord Monck; to meet to-day.

Petitions have been presented against the Mond Gas Bill by the following bodies: The Birmingham, Smethwick, Walsall, West Bromwich, and Wolverhampton Corporations; the Oldbury, Tipton, and Sedgeley Urban District Councils; the Halesowen and Kingswinford Rural District Councils; and the Bilston, Dudley, Willenhall, and Wolverhampton Gas Companies. Petitions have also been presented against the South Metropolitan Gas Bill, by the Corporation of London; the Corporations of Fulham, Hackney, Kensington, and West Ham; the London County Council; the Council of the Metropolitan Borough of Paddington; and the East Ham Urban District Council.

The York Town and Blackwater Gas and Coke Company, Limited, have petitioned against alteration in the Aldershot Gas and Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read the first time, and referred to the Examiners: Gas Orders Confirmation Bill, Newport (Isle of Wight) Gas Bill, Smethwick Corporation Bill.

Lords Bills reported, with amendments: Chester Gas Bill, Poulton-le-Fylde Gas Bill, Prestatyn Water Bill.

Bills read the third time and passed: Blackburn Corporation Bill, Otley Gas Bill, Wallasey Improvement Bill.

Exemption of Gas-Fittings on Hire from Distress.—We learn that the Local Government Board are inserting in certain Gas Provisional Orders Bills this session a clause enacting that any fittings let for hire to consumers "shall not be subject to distress, or to the landlord's remedy for rent, or be liable to be taken in execution upon any process of any Court or any proceedings in bankruptcy against the persons in whose possession the same may be, provided that such fittings have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed thereon sufficiently indicating that the undertakers are the actual owners thereof."

Ripon Gas Supply.—According to the accounts of the Ripon Corporation Gas Department, during the twelve months to March 31, the quantity of gas made was 39,500,000 cubic feet, a decrease on the previous year of 500,000 feet; the gas sold being 30,921,930 feet, or a decrease of 968,510 cubic feet. The coal carbonized amounted to 4618 tons, which yielded on an average 8554 cubic feet of gas per ton. The gas sold was equal to 6696 cubic feet per ton, showing a leakage of 16·5 per cent., the same as the previous year. Part of the leakage was owing to the laying of new mains, the bad condition of the old holder, and condensation. No cannel coal was used. From the balance-sheet, it appears that the loss, after payment to sinking fund and interest, amounted to £1093; and exclusive of sinking fund and interest, the profit was £89. The sum of £1118 was due to the Treasurer on the gas reserve fund account. The loss on the coal contracts rejected by the Council in February of last year amounted to £575 for coal, and £110 extra cost of labour and storage, in consequence of the altered conditions of delivery in the new contracts.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, June 17.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* VAUGHAN WILLIAMS *and* STIRLING.)

St. Helens Corporation v. United Alkali Company, Limited.

This was an appeal by the defendants, asking for judgment or a new trial, in the case of an action which came before Mr. Justice Bucknill and a Special Jury at Liverpool last December,* in which plaintiffs obtained a verdict and judgment; the sum to be assessed against the defendants for the damages caused to their gasholders and other property by an explosion which occurred on the Company's premises on May 12, 1899, by which several persons lost their lives, and considerable destruction was caused.

Mr. J. WALTON, K.C., and Mr. HORRIDGE, K.C., appeared for the appellants; Mr. DANCKWERTS, K.C., Mr. CLARKE HALL and Mr. HUTCHINSON represented the respondents.

Mr. WALTON narrated the circumstances of the case, which were briefly as follows: The defendants were manufacturers, among other things, of chlorate of potash. Some empty casks, which had been returned from Messrs. Bryant and May, which it was supposed had some splashes of match composition upon them, by rubbing against each other caused sparks which set light to the factory. The fire soon obtained a strong hold, and after a short time spread to a part of the building in which there was a large quantity of chlorate of potash, amounting to several tons, stored in kegs. After a certain time, an explosion occurred, causing the damage complained of to the plaintiffs' property. The learned Counsel's argument, which was developed at great length, was that, assuming there was negligence in allowing the fire to take place, the damages arising from the explosion were too remote to be recoverable in law. Up to the time of the accident, it was believed, even by scientific men, that chlorate of potash was not in itself an explosive, though it was well known and used as one when mixed with other substances, such as powdered sulphur or carbonaceous matter. For this statement he relied on the evidence of Dr. Best, the manager of another works belonging to the defendants, who was on the spot at the time of the fire, and who remained close to the burning building until the flames burst forth (having no idea that an explosion would occur), and also on that of Dr. Dupré, who, in conjunction with Colonel Ford, investigated the matter on behalf of the Home Office. In his report, he stated that an explosion of chlorate of potash had been hitherto unknown, either in the United Kingdom or in any other country; and he was utterly unable to account for the occurrence. Counsel therefore contended that potassium chlorate was not such a substance as placed those dealing with it in the position of people who kept a wild beast, who had been held responsible for any injury which might be inflicted as the result of their action; but that actual negligence in its management must be proved, in order to fix the owners with liability. He acknowledged that the defendants were liable for the direct consequences of the fire, but submitted that the effects of the explosion were too remote to be recoverable from the defendants.

Mr. HORRIDGE followed, and drew attention to some portions of the evidence and to the findings of the Jury; contending that, on these, the defendants were entitled to judgment.

Tuesday, June 18.

On the resumption of the hearing,

Mr. HORRIDGE read and commented on a few passages from the judgment of Mr. Justice Bucknill in ordering the verdict to be entered for the plaintiffs, and submitted, on the authority of previous decisions, that the damages caused by the explosion were too remote to allow of their being fixed.

Mr. DANCKWERTS, for the respondents, suggested that the appellants had altered their case as made at the trial, when he contended that Mr. Walton had admitted, in the course of the discussion on the questions to be submitted to the Jury, that chlorate of potash, even unmixed, was a dangerous substance. He read several passages from this discussion, and also from the evidence, with the view of showing that the answer to the first question put to the Jury—"Is potassium chlorate of itself a dangerous substance?"—which they answered in the negative, had not the importance which the appellants now sought to attach to it. He was also prepared to maintain, on the authorities, that if a man brought on to his land anything which was not there naturally, he was answerable for any consequences which might result, quite irrespective of the knowledge that it was dangerous. But, even if knowledge was requisite, the Jury had found that the defendants ought to have possessed it.

The MASTER OF THE ROLLS asked Mr. Danckwerts if he would be content if the Court found in his favour on the question of negligence.

Mr. DANCKWERTS said certainly; so long as he secured the verdict, he was satisfied.

Mr. WALTON was thereupon called upon to reply on this point. He repeated his former argument that, on the evidence, there was no reason to fear any such explosion as here took place, and therefore there was no negligence in the storing of the chlorate where it was, though there might have been in respect of the fire.

The MASTER OF THE ROLLS, in giving judgment, said this action was founded on two grounds—one of which was called the doctrine of *Fletcher v. Rylands;* the other that of negligence. The negligence complained of was that the defendants stored a large quantity of chlorate of potash on their premises, and allowed a fire to take place which became so intense that the chlorate exploded and wrecked the plaintiffs' gas-works. The action went to trial; and, after a great deal of

* See "JOURNAL," Vol. LXXVI., pp. 1463, 1525, 1588.

scientific evidence had been called, the Jury answered various questions which were put to them by the Judge, with the acquiescence of Counsel on each side. The question now was whether the defendants were entitled, on these findings, to have the verdict and judgment entered for them. It was not necessary to go through the circumstances in detail; it was sufficient to say that the fire was occasioned by the defendants' negligence in bringing into their refining-house, which was saturated with chlorate of potash, and therefore highly inflammable, empty casks returned from a match factory. Some friction of these casks was said to have caused a spark, and the whole place was quickly on fire. It was also said that there was negligence in having the settling-tanks made of wood instead of metal. The chief point made by the defendants was that they had no idea that chlorate of potash by itself would explode, though they knew it would burn; and, inasmuch as the damage was done by the explosion, and not by the fire, they were not liable. A great deal had been said about the first finding. He thought too much importance was attached to it; for, as he understood it, the Jury merely meant that chlorate of potash, if left alone, would not take fire or explode spontaneously. The third finding was a plain answer to a plain question, and said that the defendants ought to have known that chlorate of potash was explosive when unmixed with other substances; and he did not see that it was inconsistent with the first one. This seemed to him to be the governing answer; and there was a considerable body of evidence to support it. Under these circumstances, in view of the finding, how could it be said that the damages were too remote? The finding seemed to him conclusive; and the alleged remoteness of the damage did not avail the defendants. Upon the other point, based on *Fletcher v. Rylands*, that the defendants were liable simply because they had a dangerous commodity on their premises, it was not necessary to give a decision.

Lord Justice VAUGHAN WILLIAMS concurred, though he did not take quite the same view of the first two findings as the Master of the Rolls. He thought the questions were put with a view of ascertaining whether the matter came within *Fletcher v. Rylands* (in which case it would not have been necessary to prove negligence), or within the limitation of the doctrine depending on the knowledge of the defendants as laid down by Mr. Justice Blackburn and affirmed by the House of Lords. His view was that, according to the findings of the Jury, the case was entirely outside of *Fletcher v. Rylands*, and the whole question was therefore one of negligence. He agreed that this was both admitted and proved, and that the damages claimed were not too remote.

Lord Justice STIRLING also gave judgment to the same effect.

The appeal was therefore dismissed, with costs.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Tuesday, June 11.

(*Before Justices* RIDLEY *and* BIGHAM.)

New River Company v. Assessment Committee of the Hertford Union and Others.

This was a special case stated by the Justices at the Hertford Quarter Sessions for the opinion of the Court; the question raised being the rating of the intake of the New River Company at the point where the water is drawn from the River Lea. The case set forth that on the 15th of October last an appeal against a certain poor-rate for the parish of St. John, in the Hertford Union, made in May, 1900, whereby the appellant Company were rated in the sums of £787 *plus* £3280 gross estimated rental, and £650 *plus* £3180 net rateable value, was heard and determined by the Justices. The history of the appellants and of their right to take water from the River Lea was contained in their Charter and the following statutes, which formed part of the case: 3 James I., cap. 18; 12 Geo. II., cap. 32; the Lea Navigation Improvement Act, 1850; the River Lea Water Act, 1855; and the Lea Conservancy Acts, 1868 and 1900. Shortly stated, the facts appearing from these statutes were that the appellants were formed under a Charter granted in 1618 by King James the First for the purpose of bringing water from certain springs at Chadwell and Amwell, in the county of Hertford, to London. For many years prior to 1738, the appellants had taken considerable quantities of water out of the River Lea; the point of intake being at a place called Chalk Island, in a channel of the river called the Manifold Ditch, from which the water so taken flowed by means of an artificial cutting into the New River. In the year 1738, by 12 George II., cap. 32, the appellants were permitted, under section 5, to take a specified quantity of water from the Lea through the Manifold Ditch, which, together with the water running through it, was vested in the Company, who were directed to pay to the Trustees appointed to carry out the Act two capital sums amounting to £3250 and two other annual sums amounting to £350, which were to be applied to purposes relating to the navigation and the purity of the water of the river. In 1850, the Lea Navigation Improvement Act gave the Trustees of the river the right to sell surplus water to certain Water Companies; and the appellant Company for three years made an annual payment of £1500 for water so purchased by them and supplied at an intake near Tottenham. This intake had not been used since the year 1855; but it might still be used. In 1855, by the River Lea Water Act, the annual payments under the above-mentioned statutes ceased, and in lieu of such payments an annual sum of £1500 and a capital sum of £42,000 were directed to be paid by the appellants. In return for these and other payments to be made by the East London Water-Works Company, this statute vested in the appellants and that Company all the water flowing in the River Lea, except so much as was required for navigation, in improving which the Trustees were directed to spend £30,000 of the £42,000. The Act also contained provisions for the regulation of the quantity of water to be taken by the appellants from the river through the Manifold Ditch, and required them to construct a new gauge, which, with a house or building to contain it and the requisite machinery, was erected in or about the year 1859, near the point of intake. In 1868, by the Lea Conservancy Act, the appellants were directed to pay an annual sum of £600 to the Corporation of Hertford, and the Company and the East London Water-Works Company were directed to pay an additional aggregate yearly sum not exceeding £1000, of which the appellants were to pay one-third to the Conservators of the River Lea (the successors of the Trustees), for purposes therein specified relating to the purity of the water of the river. Since the year 1868, the appellants had paid to the Conservators under the statutes an annual sum of £1833 6s. 8d., and had paid to the Corporation of Hertford an annual sum of £600. By section 25 of the Lea Conservancy Act, 1900, the aggregate yearly sum payable by the appellants and the East London Water-Works Company under the River Lea Water Act was to be increased to £8000, of which £3750 was to be paid by the appellants; and from and after the same date, the additional aggregate yearly sum payable by the two Companies, under section 131 of the Lea Conservancy Act, 1868, was to be increased to £2000. The parish of St. John, in respect of which the rate in question was made, was formed under the Local Government Act, 1894. From 1876 to 1894, the appellant Company's property in the parish of St. John was rated at £350, and in the Liberty of Little Amwell at £500; and the figures had not been materially altered since 1859. Until January, 1900, the property of the appellants in the parish of St. John had never been assessed at more than £650 rateable value. In that month, however, by a supplemental valuation list, subsequently confirmed by the Assessment Committee, further sums of £3180 and £650 were added to the rateable value in the assessment of the property in the occupation of the appellants. The property assessed at £650 was described as the "Chadwell Spring—portion of the New River gauge-house, sluice, and appurtenances;" and the property assessed at £3180 was described as "Intake from River Lea." The Company appealed against the rate upon the following grounds: That they were overrated; that they did not occupy any rateable hereditament in the parish coming within the description of the "intake from River Lea;" and that no rateable hereditament coming within that description had any existence in the parish. It was proved and admitted that the sum of £3180 was arrived at by the professional valuer who made the supplemental valuation list by taking 4 per cent. upon the capital sum of £42,000—namely, £1680—and the annual sum of £1500 directed to be paid under the Act of 1855; but the respondents admitted that, though these sums might be *primâ facie* evidence, they were not necessarily the measure of the rateable value. It was contended on their behalf that, beyond the rating of the intake at its structural value and value as land, it ought to be rated in an additional sum as having an enhanced value in respect of the use made of it by taking water from the Lea into the channel of the appellants; that the sums of money which they had paid under the statutes were evidence that the land and the buildings erected thereon had some additional value beyond the structural value thereof in respect of the use made of them, and that such additional value was sufficiently great to support the rate appealed against; and that the additional payments directed by section 25 of the Lea Conservancy Act, 1900, were evidence to show what, in the opinion of Parliament at the date of the passing of the Act, user of the intake was worth to the Company. The appellants contended that all their rateable property in the parish was already rated in the item £650; that no addition ought to be made to the assessment in respect of the water flowing over the intake or of the user of the intake by such water flowing over it; and that the intake ought not to be assessed upon, or with reference to, the moneys represented by the item £3180, which were paid for the purchase of water and the right to divert water from, and control the water in, the River Lea, or with reference to the sums payable under the Act of 1900. The Court of Quarter Sessions dismissed the appeal; and the question for the Court was whether the property was rateable upon the principle contended for by the respondents. If so, the judgment was to stand; if not, then either the gross and rateable values were to be reduced respectively to the sums of £787 and £650, or the Court was to make such other order therein as it should think just.

Mr. F. MARSHALL, K.C., and Mr. R. D. MUIR appeared for the appellants; Mr. BALFOUR BROWNE, K.C., and Mr. WALTER RYDE represented the respondents.

Mr. MARSHALL said the question for their Lordships' decision was whether the Company's intake ought to be rated—as it had been, for as long as could be recollected, until the beginning of last year—upon the value of the land occupied, and the structural value of the intake, or whether there ought to be added an annual sum of more than £3000 in respect of what the respondents described as the "user" of the intake by the flowing of the water of the river over it. They had founded this figure upon some annual payments made by the Company to the Conservators of the River Lea; and, in fact, they were seeking to assess the value of the water procured from the river and add it to the structural value for the purposes of assessment.

Justice BIGHAM: Does this channel of the New River go into other parishes besides this one?

Mr. MARSHALL: Yes, a great many.

Justice BIGHAM: Do they seek to charge you with the value of the water?

Mr. MARSHALL: They never have done so up to the present time.

Justice BIGHAM: If this principle is right, why should not each parish charge you? If they did, I do not know what the price of water would be when it reached London.

Mr. MARSHALL: It would be multiplied a dozen times before it got there. It would be assessed over and over again. The Quarter Sessions have held that the Overseers were right, and instead of being assessed this year at £650, we are assessed at nearly £4000 to begin with. There is another Act of Parliament which threatens us with further charges; so I do not know where we shall get to presently.

Mr. RYDE said their case was that the value of the land had been enhanced by the right which the Company enjoyed to take water over it.

Justice BIGHAM: You say anyone renting this place would pay a rent, having reference to the fact that the tenant was entitled to take this water?

Mr. RYDE: I say anyone using this property in the same way as the appellants, would be glad to pay a rent of £3000 a year for the right to use it in that way.

Justice BIGHAM said it appeared that the question the Court had to

decide was whether, in arriving at the amount, the Assessment Committee ought to take into consideration the item which appeared in the assessment as "Intake from River Lea."

Mr. MARSHALL: Which is something beyond the thing itself, and which they describe in their contentions in the case as the "user" of the intake of water.

Justice BIGHAM: I wish you would tell us in your own way what you say the proper principle is.

Mr. MARSHALL stated his principle as follows: That the property to be assessed as a whole must be divided into the directly contributive part and the indirectly contributive part. So far as the indirectly contributive part was concerned, the principle was that it should be rated upon its structural value and the value of the land.

Justice BIGHAM: First of all, do you say that the property within this parish is property which comes within the meaning of "indirectly contributive"?

Mr. MARSHALL: Yes.

Justice BIGHAM: And do you say that indirectly contributive property must be assessed at a rental to be ascertained with reference to the value of the land, and of the buildings, having some regard to the cost?

Mr. MARSHALL: Yes.

Justice BIGHAM: Do the respondents dispute that this property is indirectly contributive?

Mr. MARSHALL: No.

Justice BIGHAM: Do they say that, though it is indirectly contributive, it nevertheless is to be rated on a different principle?

Mr. MARSHALL said they did, and, as he understood, on something beyond the value which he had just mentioned, in respect of the use to which it was put, on the user itself. They wanted to rate the supply of water, or the right to get it.

Justice BIGHAM: But you have a statutory right to the water.

Mr. MARSHALL: Yes; it is ours all the way down from the source to London, except that which is required for navigation.

Justice BIGHAM: That is, you are receiving your own goods.

Mr. MARSHALL said it was very like charging a gas company with an increased assessment for the use of the gates by which the coal came into their works, after having assessed the mine for the coal. If this were permissible, the appellants might be rated in twenty parishes.

Justice BIGHAM: At present, if this assessment is retained, I do not see why you should not be assessed in every parish through which you carry water.

Mr. MARSHALL said he put that point to the Justices; but they did not appreciate it. The respondents' way of putting it was that it enhanced the value of the land—in other words, the value of the coal enhanced the value of the gates through which it came. He could not help thinking that what lay at the bottom of the matter was this fact: The Overseers saw that the Company were making large profits, and they thought they ought to have some of them; but the Company could not pay both in London and in Hertford. Counsel quoted a number of previous decisions in support of his contention.

Mr. RYDE then addressed the Court for the respondents, on the lines indicated in the special case.

Without calling on Mr. Marshall to reply, their Lordships delivered judgment

Justice RIDLEY said the case was one of some importance, but he thought the questions raised were concluded by many previous authorities. The only one to which he need specially refer was that of *The Liverpool Corporation v. The Assessment Committee of the Llanfyllin Union*, decided by the Court of Appeal in 1899,* which was very similar to the present case. In that case the Corporation were empowered to construct a reservoir and other works in a parish in Wales, for the purpose of supplying water to Liverpool. The construction of the reservoir and works involved the submersion of the sites of the parish church, vicarage, and schools, and the stopping up and diversion of certain roads; and the Act required the Corporation to erect new buildings and make new roads. The Corporation, having been rated to a poor-rate in respect of the reservoir and works, appealed to Quarter Sessions, who decided that, in estimating the value of the reservoir and works for the purpose of arriving at the rateable value, the amounts expended by the Corporation in providing new buildings and roads ought to be included as being part of the capital cost of the works; and the Court of Appeal held that there was nothing wrong, in point of law, in the decision. Lord Justice Smith said: "It is familiar law that where a hereditament can be compared with other hereditaments of a like nature, its rateable value may be arrived at by showing what rent tenants from year to year will, in fact, give for such hereditaments; but the difficulty in rating law arises with regard to hereditaments which cannot be compared with other similar hereditaments so as to ascertain the rent which a tenant will actually give for them. In such cases, it has come to be a recognized position that the rent which a hypothetical tenant would give for the hereditament must be estimated in some other way. In a case like the present, where no profits are earned in the parish by the use of the hereditament, a rough way of arriving at the rateable value by rule-of-thumb is to see what the site and the construction of the works cost, and take a percentage on the capital amount so expended as representing the rent which the tenant would give. The problem with regard to the mode of estimating the rateable value in a case of this kind has been simplified by the introduction some years ago of the principle that the occupying owner of the hereditament may be considered as a possible tenant." Therefore in that case the principle was clearly laid down, and it was impossible to argue that it did not apply in this case. Was it, therefore, right that this increased assessment, which represented what was called the "user" of the water, was part of the cost of construction, which ought to be estimated and taken into account? He thought it was not. He considered that there was included in the old assessment all that could be properly the subject of assessment—namely, the cost of the land and the structures. The intake of the water was no part of the construction; and they could not logically connect the two things in any way whatever. There was also another objection—that the right to take the water was not connected with this piece of land. There was power still remaining to transfer the intake elsewhere. Therefore he thought the assessment was wrong, and that it ought to be restored to the original figure.

Justice BIGHAM agreed.

The appeal was accordingly allowed, with costs, reducing the assessment; but leave to appeal further was granted.

* See "JOURNAL," Vol. LXXIII., p. 1382.

COURT OF SESSION—BILL CHAMBER.

Thursday, June 20.

(*Before Lord* PEARSON.)

Alleged Infringements of the Welsbach Patents.

To-day his Lordship had before him applications by the Welsbach Incandescent Gas-Light Company, Limited, against five parties in Scotland, asking that they should be interdicted from infringing the Complainers' patent of Nov. 3, 1893, by the manufacture, sale, or use of incandescent gas-mantles. The respondents were: James Martin, carrying on business as A. B. Martin and Co., at 11, Bell Street, Dundee; George Terry, *alias* George Roberts, carrying on business as N. Godfrey and Co. at 19, Howard Street, Glasgow; Robert Brymer and John Fyfe, carrying on business as Brymer and Fyfe, and also as the American Agency Company, at Arcade Buildings, 8B, King Street, Dundee; George Munro, carrying on business as the General Supply Company at 65, Jamaica Street, Glasgow, and Mrs. Mary Archibald or Munro, his wife; and James Wilkie and Alexander Wilkie, carrying on business as J. & A. Wilkie, wholesale incandescent fitting stores, at 211, Hilltown, and 88, Albert Street, Dundee, and as the Albert Cycle Depôt at 88, Albert Street. All the respondents denied infringement, and said there was nothing new in the invention patented in 1893 which was not contained in patents which have now expired. Martin, Brymer, and Fyfe, and J. & A. Wilkie also said they did not now sell mantles. On behalf of Terry and Munro, it was stated that they sold mantles which were manufactured by the Guaranty Incandescent Mantle Company of London, against whom the present complainers had applied in London for an injunction, and that interim injunction had been refused.* It was further stated that Mrs. Munro was agent of the Guaranty Company, and that Munro carried on business as a cycle dealer.

Mr. CLYDE, for the complainers, pointed out that while an interim injunction was refused last November in London, the case was proceeding on its merits, and would be heard shortly. He also founded upon a certificate granted by Mr. Justice Channell in a previous case, to the effect that the validity of the patent of 1893 had come into question, and maintained that this virtually settled the point as to the validity of the patent. The respondents were the same people at "the same old game." The question raised was this—that in the original patent cerium was not mentioned, while in the patent of 1893 it was; but that in the original patent the thorium was impure to the extent of 25 per cent. (which the public did not know), and part of the impurity was cerium. Therefore it was argued that the use of cerium in the 1893 patent had been anticipated.

Mr. D. ANDERSON, for the respondents, maintained that the patent of 1893 had been anticipated. It was a very serious matter to fight the Welsbach Company, who, he understood, had briefed all the eminent Counsel, and who had all the most distinguished chemists on their side. The Guaranty Company's mantles were at present sold in England, and it would be unfortunate if the sale of them were to be interdicted in Scotland.

Lord PEARSON remarked that he supposed the Guaranty Company was a guarantee against molestation.

Mr. ANDERSON: The Company is the United Chemical Company.

Mr. CLYDE: It is the usual thing—they have changed their name. The United Chemical Company is now the Guaranty Company.

Lord PEARSON said he thought the certificate granted by Mr. Justice Channell was issued under statutory authority, the intention of which was that parties who had a good patent should not be harassed by infringers who would not come to trial. It operated as a warning, not only that the patent had been challenged, but that it had been found to be valid. There were grounds for the refusal of the interim injunction in England which did not exist here; and he did not think there was anything very startling in the fact that a person might sell a given mantle in England and not in Scotland, as would induce him to make any exception on that point to the ordinary rule. He therefore passed the cases into the Court of Session for trial, and continued in each case the interim interdict which had been previously granted.

INVALIDITY OF THE BELGIAN WELSBACH PATENTS.

Judgment of the Court of First Instance.

In the "JOURNAL" for the 4th inst. (p. 1496), it was briefly announced that the proceedings commenced in the Brussels Court to obtain a declaration as to the invalidity of the Belgian Welsbach patents had been entirely successful. The action was instituted by MM. De Brouwer and Tricot; the defendants being the Anglo-Belgian Welsbach Incandescent Gas-Light Company, Limited, and the Société Anonyme Belge d'Incandescence par le Gaz, Système Auer (in liquidation). The following is a translation of the judgment given by the Second Chamber of the Court of First Instance on the 29th ult.

The four Belgian patents investigated in the suit, and belonging to the defendant Companies, all relate to the manufacture of incandescent bodies for gas-burners. The Belgian patent of Nov. 16, 1885, had regard to a complex invention—to wit, the construction of incandescent mantles which have since then come into general use, and their impregnation by the aid of various bodies possessing an illuminating power in consequence of their combination. Among these bodies, the inventor mentioned the cerite earths containing only a small quantity of cerium. The amended patent of Sept. 30, 1886, indicated only other

* See "JOURNAL," Vol. LXXVI., p. 1279.

bodies, the combination of which with the preceding would, said the patentee, give advantageous results, especially pure thorium, with or without the addition of the before-mentioned oxides. It is certain that in 1885 and 1886 commercial thorium contained a certain amount of cerium, and that consequently, supposing the *rôle* of the latter element to be dubious, the before-mentioned Auer patents covered all manufacture of incandescent mantles for gas-burners due to a mixture of thorium and cerium. Continuing his studies on the invention to which he gave his name, Dr. Auer found that the most efficacious mixture of thorium with the other oxides was 99 to 1. The patent dated Dec. 31, 1892, taken out for "a new incandescent body," recommended the combination of oxides of thorium and uranium, which could be replaced by oxide of cerium, samarium, terbium, neodidymium, praseodidymium, and other rare earths. It must be remarked that if the claims of the specification did not specify the proportions of the mixture, the preliminary description set forth that the light attained its maximum intensity when the proportion amounted to about 99 to 1. Finally, the specification dated April 15, 1894, repeats the language of the patent of 1892, with the addition of yttrium and ytterbium to the oxides therein enumerated, but without specifying the proportion of the mixture.

The object of the suit is—

1.—Nullification of the patents of 1892 and 1894, as their object would be included in that of the patents of 1885 and 1886.

2.—Rectification of the qualification assigned to the patent of 1892, which would be, in reality, not a patent as represented by the inventor, but a mere amended specification entitled to no other term of existence than the master patent of 1885.

On the first point, the patent of April 15, 1894, enumerates two bodies different from the others mentioned in the patent of 1892, the descriptions of which it completes. The patent of Dec. 31, 1892, positively states that there is a certain novelty, the nature and importance of which will be investigated when considering the second point, but the reality of which is not doubtful. It specifies the composition of the liquid for impregnating the mantle intended to emit light in the state of incandescence; and its industrial result, regarding which the parties are agreed, is to about quadruple the lighting power of burners hitherto employed, by the application of the patents of 1885 and 1886. In this respect, the patent should escape the nullification claimed in regard to it.

On the second point, legally, one must ascertain what are the patents which should be classed among the amendments provided by articles 15 and 35 of the law of May 24, 1854. Article 15 states that the amendment must consist of "a modification of the object of the discovery." It results from these words that there is an amended patent, and not a new or master patent, as long as the patent concerns a change which respects the essential elements of the object of an invention previously patented As indicated by the word "amendment," employed several times by the Legislature, the amended patent may comprise particularly an improvement. It is of importance to remark that an absolute distinction is to be made between the chief object (process or product) and the industrial result or advantage obtained. It thus results that a patentable improvement will be a simple amendment, if it respects the object of the master patent, though modifying its practical effects. In other words, the amendment may consist not only of a modification of details in the processes, but also in an advantageous change made in the effects of the invention, so long as the object of the invention remains such as it was described in the master patent. The question is to ascertain whether such is the case here.

The patent of Dec. 31, 1892, determines with much greater precision than the language of the patents of 1885 and 1886 the *rôle* of thorium and other rare earths, especially uranium and cerium; but, though mentioning a proportion of 99 to 1 of thorium and uranium oxide or cerium, it does not claim this percentage, but merely the discovery of the combination of thorium, uranium oxide, or cerium, without giving any formula. As stated by the Court of Verviers (Jan. 19, 1900), this invention does not produce a qualitatively new product; it originates in the patents of 1885 and 1886 in as precise a manner as science permitted at the date of these patents. In fact, in the patent of 1886, Auer regarded as his object the construction of mantles impregnated with a combination of certain bodies, among which he indicated the cerite earths containing only a little cerium. He took care to add that the proportion of the mixture was not invariable, and might be modified. In the amended patent of 1886, he claimed the same invention; mentioning thorium and other oxides as bodies which could be combined with those already specified. In such circumstances, the patent of 1892 seems to be an improvement which is certainly important on account of its industrial advantages, but not from having a different object from that of the patents of 1885 and 1886. The object of these patents is the same; it is, as runs the preliminary description at the head of the patents of 1892 and 1894, the incandescent body for gas-burners employed in the Auer system. The modification of 1892 consists in a more precise determination of the bodies to be combined in order to assure incandescence. The improvement bears upon the efficiency or the luminous power.

The following circumstances confirm this method of appreciating the patent of 1892, comparatively with the preceding.

A.—In taking the 1886 patent regarding thorium, Auer himself qualified it as an amendment; thus admitting that an improvement of the incandescent body constituted a simple modification in the object of the patent of 1885.

B.—The defendant companies have taken note of, prosecuted, and had condemned, on several occasions, as counterfeiting, the employers of the process patented in 1885 and 1886 when the mantle-impregnating mixture was not identical, but analogous, with that described in the patents—*i.e.*, when the proportions varied. (*Vide* decision at Brussels, July 6, 1897, Stella case; do., July 6, 1897, Blancke case; do., March 29, 1899, Kessler case; do., decision at Verviers, Jan. 10, 1900, Blancke case.)

C.—Auer and his assignees, having obtained English patents corresponding to the Belgian patents of 1885 and 1886, subsequently applied for amended patents resulting from the thorium-cerium combination, though omitting to distinctly and exclusively claim the proportion 99 to 1; and they qualified this amendment (English patents of July 29, 1886, and Jan. 3, 1895, qualified "improvement" as regards the original patent of Dec. 12, 1885, No. 15,286).

D.—They acted in a similar way in Germany, where their original patent of Sept. 23, 1885, No. 39,162, similar to the Belgian patent of 1885, was followed by two patents—one for the employment of thorium in various proportions, and the other for the thorium-cerium mixture in the proportion stated, and not claimed, of 99 to 1, both of them being qualified as addition or improvement (Susatz's patent, April 29, 1885, and Aug. 15, 1891).

The defendant Companies insist, it is true, on the enormous progress realized by the invention of 1892 in gas lighting by quadrupling the efficiency of burners, and endeavour to argue from this fact that the invention might constitute a master patent instead of an amendment. As already stated, the inherent advantage of a slight modification makes no alteration in the object from the point of view of the application of Article 15 of the law of May 24, 1854. Yet the defendant Companies maintain that, as it is a question of chemical combination, the proportions play an essential part, so that in the four disputed patents there would be as many objects as definite combinations, and that the patent of 1892 would be absolutely distinct from those of 1885 and 1886.

This argument, which, in theory, might be accurate, is not applicable to the patents in question, because (1) the common object of the patents is really the complete invention of Auer characterized by the combined incandescent mantle and the bodies employed for its impregnation, (2) none of the patents distinctly or exclusively claimed a fixed proportion in the mixture specified as forming the object of the invention, (3) the patent of 1885 states expressly that the proportions may vary, and (4) the patent of 1892 itself only gives the proportion 99 to 1 of thorium as an approximative example, without distinctly claiming it—the preliminary description giving a proportion of about 1 per cent.

Lastly, the defendant Companies oppose certain foreign administrative and judicial decisions which declared that the Auer invention, as regards thorium and cerium, would not constitute an amendment covered by the claims of his previous inventions, but a novelty involving a real revolution in the industry of gas lighting. These decisions should, on the one hand, be compared with the text of certain patents obtained in foreign countries, and, on the other, with the peculiar legislation of the countries in question—a double circumstance, forming an obstacle to the defendant Companies invoking, with useful effect, these precedents in the present case.

For the reasons given, the Court declares that the Belgian patent of Dec. 31, 1892 (No. 102,675), belonging to the defendant Companies, was wrongly qualified as an invention, and should be qualified as an amendment, the term for which cannot exceed that of the Belgian patents of Nov. 16, 1885 (No. 70,759) and of Sept. 30, 1886 (No. 74,502); also that the Belgian patents of Dec. 31, 1892 (No. 102,675) and of April 15, 1894 (No. 109,235) are not void by application of Article 15, section 1, of the law of May 24, 1854; and condemns the defendant Companies to pay the costs.

Electricity Supply by Gas Companies.

In the Chancery Division of the High Court of Justice last Saturday, a petition by the Uppingham Gas Company, under the Memorandum of Association Act, 1890, asking the confirmation by the Court of a Memorandum and Articles of Association, to take the place of the Deed of Settlement under which the Company were originally constituted, in accordance with special resolutions which had been duly passed, came before Mr. Justice Byrne. Mr. Edwards appeared for the petitioners. The memorandum enlarged the objects of the Company, not only by extending their operations to the county of Rutland, but also by giving them power to provide and supply electricity, either for lighting or motive power. The objects were set out in great—and, as his Lordship considered, unnecessary—detail; and two or three of them were struck out, including one authorizing dealing in motor carriages. With these exceptions his Lordship approved the Memorandum. Mr. Edwards then went through the Articles, which were also approved, with one or two slight alterations. For instance, under the original deed, the voting power was one vote for four shares, two votes for five to nine shares, and three for ten and upwards. It was proposed to give one vote for five shares, two votes for ten, and three for a larger number; but his Lordship declined to make any alteration in the voting power, in the absence of any evidence to show why it should be done. The petition had been referred to the Master, who had reported generally in its favour; but he raised some question as to the validity of the resolutions which had been passed, especially having reference to the fact that the capital had been increased from £4000 to £8000. He ultimately, however, decided that the resolutions were validly passed, and confirmed the Memorandum and Articles subject to the alterations mentioned.

The Nuisance from the Leyton Electric Light Works.

In the Chancery Division of the High Court of Justice, on Monday last week, Mr. Justice Buckley had before him the case of *Hawkes v. Leyton Urban District Council*, which had previously been under his consideration as well as that of the Court of Appeal (*ante*, p. 1327). On the 14th ult., he made an order which, among other things, stayed the operation of a writ of sequestration granted against the defendants. Affidavits were read showing what the defendants were doing to substitute steam power for gas-engines in working the electric lighting plant; and, by consent, his Lordship further stayed the operation of the sequestration for 18 months or further order, with liberty to either party to apply. Subject to this, the previous order was substantially continued. The defendants were ordered to pay the costs of the present application and of the last hearing; and directions were given for an affidavit to be produced showing that the gas plant had been actually disconnected.

Longford Gas Company and the Irish Provincial Gas Company.

In the Chancery Division of the High Court of Justice of Ireland last Tuesday, the Master of the Rolls had before him a petition by the Longford Gas Company to stay proceedings for the winding up of

the concern, and to obtain an order that the Liquidator should restore to the Company's Manager all their assets. Mr. L. Law-Smith said the Company was formed in 1857 with a capital of £3500, in £3 shares. A Company, called the Irish Provincial Gas Company, was formed last year to purchase gas-works all over Ireland, and they agreed to buy out the Longford Company. A resolution was accordingly passed for winding up; and the necessary proceedings were taken for the purposes of the sale. But the Provincial Company failed to float, and, of course, the sale did not come off. It was now sought to continue the Longford Company as before, and to stay the winding-up proceedings. The undertaking was now, and always had been, solvent and prosperous. The Master of the Rolls granted the petition.

Alleged Unauthorized Fixing of Gas-Regulators.

At a recent sitting of the Salisbury County Court, Messrs. Mason and Co., of 110, Strand, London, sued Mr. G. Richardson, County Hotel, Salisbury, for £4 for two gas-regulators supplied, and for fixing the same in the hotel. The plaintiffs' case was that defendant gave the order for the two regulators, and that they were duly fixed. When they asked for the account to be settled, Mr. Richardson repudiated the order. The defence was that Mr. Richardson distinctly refused to have the regulators put in the hotel, and that they were fixed there by plaintiffs' agents when he was away from the city. The first time defendant became aware that they had been fixed was when plaintiffs applied for the money. Mr. Norton H. Humphrys, the Engineer of the Salisbury Gas Company, was called to prove that the regulators were useless to defendant, as the pressure of gas in that part of the town was not sufficient to make them act. But the real issue of the case was whether defendant gave the order. His Honour, in giving judgment, said as the onus of proving the case lay upon the plaintiffs, he must hold that they had not made out their claim; and there must therefore be judgment for the defendant. His Honour added that plaintiffs must be allowed to take away the regulators, if they desired to do so. A representative of Messrs. Mason and Co. asked whether his firm were to go to the expense of unfixing the regulators. His Honour: I'm afraid this is a case of sewing buttons on another man's coat. You must either cut them off again, or allow him to strut about in a coat beautified by your buttons.

Stamping Gas Companies' Agreements.

At the Greenwich Police Court last Tuesday, Mr. Passmore attended before Mr. d'Eyncourt in support of some summonses, at the instance of the South Metropolitan Gas Company, against consumers for unpaid gas bills. He said he appeared in deference to an opinion expressed by His Worship at Southwark Police Court. Mr. d'Eyncourt said he had at that Court raised the question as to the necessity of a stamp on the contract between the Company and the consumer. Mr. Passmore said there was no doubt the contracts with the Company came under the exemptions of the Stamp Act, as they related to "the sale of goods or merchandise." Mr. d'Eyncourt pointed out that there was no sale until the gas had been used. Mr. Passmore: In any case it is a contract "relating to the sale." Mr. d'Eyncourt said the person supplied was not obliged to use any gas; and if he used it he had to pay. Mr. Passmore read the contract with the Company; and Mr. d'Eyncourt said no doubt the Company were bound to supply gas, but the person supplied need not use any, and it was not absolutely sold until it was used. He agreed, however, with Mr. Passmore that the words "relating to the sale" were sufficiently wide to exempt the contracts from the Stamp Act.

Leeds Water Profits.—The accounts of the water undertaking of the Leeds Corporation for the year ended March last show a surplus profit of £13,128, compared with £17,802 for 1899-1900, or £4674 less. Though the total income is £132,945, against £128,948, or £3997 more than for the previous twelve months, it does not meet the increased working expenses of £6357 (£34,954, against £28,597). During the year, the interest on loans also rose by £2069.

Waste Water from Industrial Centres.—The disposal of this water is a problem which for some time past has engaged the attention of municipalities in Germany. A year ago, a union of the towns in the valley of the Emscher was formed to act with the Essen Municipality in the establishment of a scheme whereby the collected drainage of these industrial towns could be led away by a common canal and clarified together before being discharged into the Rhine. An inspection of the Emscher Valley was made by a Committee selected from a commission of interested parties; but the difficulties of the scheme were found to be enormous However, a scheme has been formulated, and the necessary plans drawn up under the direction of Baumeister Middeldorf, of Berlin, who will himself commence the superintendence of the operations on the 1st prox. Eleven municipalities or parishes have joined in the scheme; subscribing in all 74,000 marks.

Burnham (Somerset) Water Supply.—On Monday last week, an event of great importance to the future welfare of Burnham took place at Webbington, when the ceremony of turning the water into the new pipes was performed by Mr. G. B. Sully, Chairman of the District Council. An explanation was made by Mr. W. J. Press, the Engineer and Surveyor of the Council, as to the scheme partially completed. It is intended eventually to make available the whole of the water on the Council's property at Winscombe and Burnham. He will lay a 12-inch main from the former place to Webbington, to supersede the present 9-inch main. The intermediate and completed stage has been to lay a new 8-inch main from the last-named place to the Brent Knoll pumping-station. By this main a daily average flow of 70,000 gallons of water, hitherto allowed to waste, is conserved. A greatly improved direction from Webbington has been found by Mr. Press, crossing the River Axe by means of steel pipes resting on steel chains placed upon steel girders; and thus the earlier necessity of passing under the river is avoided. The original scheme was to cost £4500, and the work will be done within that amount. The portion now completed was begun in November.

MISCELLANEOUS NEWS.

PLYMOUTH AND STONEHOUSE GAS COMPANY.

Low Illuminating Power Advocated—Suggested Combination Among Gas Companies.

The Annual Meeting of this Company was held at the works last Thursday—Mr. J. A. Bellamy in the chair.

After the usual preliminary business, the report of the Directors for the year ended the 31st of March was presented. At the outset they expressed their pleasure in calling the attention of the proprietors to the very satisfactory results obtained. Although the price of gas was advanced 6d. per 1000 cubic feet in June last, this was barely sufficient to meet the abnormally increased cost of coal, oil, and materials generally during the past year, together with dividends and interest; but the high prices realized for residuals gave a surplus to be added to the credit balance of the profit and loss account. The amount available for distribution was £18,317. An interim dividend had been paid in January; and the Directors recommended the payment of a dividend for the half year ending March 31 of 5⅝ per cent. on the ordinary stock, 8s. 3d. per share on the additional shares, and 7s. 9d. on the new shares, less income-tax. This would absorb £6872, and leave a balance of £11,445 to be carried forward. The price of gas coals having become lower by several shillings per ton as compared with the very high figure at which the Directors had to contract for the past year's supply, they had decided to reduce the charge for gas to 2s. per 1000 cubic feet, though a considerable quantity of oil at a high price remained to be taken on last year's contract.

The Chairman, in moving the adoption of the report and accounts, said he thought the shareholders would agree with the Directors that the business was in a satisfactory condition. The past year had been an anxious one. The high price of coal had interfered very much with the business, not only of the Company, but of every gas company in the country. He was pleased to state that the Directors had entered into a satisfactory contract for coal for the ensuing twelve months, and felt justified in reducing the price of gas at once. Owing to the unfavourable condition of the Money Market and the high price of coal, which affected the dividends of shareholders as well as the price of gas, they had not been able to issue stock as intended. They had plenty of business awaiting development, but it involved the expenditure of extra capital; and unless they were able to issue stock on favourable terms, it was not desirable to press it too far. The Directors had therefore held their hands as much as possible the last twelve months. As their affairs were worked, they had to lend stoves and fittings to thousands of persons; and a very large sum per annum had to be raised as capital to pay for them. The Directors believed they would be able to issue stock during the current year on favourable terms; and this new business would then be pushed as much as possible, because it was good As he said last year, the prosperity of gas companies was bound up more than ever before not only with gas as an illuminant but with gas for heating and motive power; and the Directors were developing this branch of the business as much as they could. While dealing with the business of the past year, he took the opportunity of expressing the thanks of the Directors to their officers and workmen. All the officials had performed their duties admirably; and the men had never done better work. There had not been the slightest friction; and the most cordial relations existed between the men, the officials, and the Directors. They made a new departure last year. They thought that when a year was gone through successfully the men deserved a little recognition; and they gave them a picnic. The men had shown their appreciation of this in many ways; and the Directors had determined to repeat it this year. Last year he said he considered the prospects of gas to be brilliant; and he thought so now. But improvement would depend on public opinion coming to the assistance of the gas companies. At present the consumers of gas for illuminating purposes were paying much more than they should do for gas, because of legislation settled years ago, when there were no incandescent gas-lights. It was then well, for the benefit of the public, that gas companies should be compelled to supply gas of certain illuminating power. Now, however, in most households, the incandescent light had been introduced, and the candle power of the gas was really of no moment. With the incandescent mantle the same light would be obtained, so far as regarded illuminating power, whether the standard of the gas was 10 or 15 or 16 candles. In Germany, where the Welsbach patent did not exist, mantles were obtainable for 1d. or 2d. each, with the result that the former high standard had been abolished, and gas companies were enabled to supply gas for illuminating purposes, and, of course, for heating and motive power, at a much lower price. He thought the time had come for a step to be taken in a similar direction in this country. It had been taken in one or two instances. The South Metropolitan Gas Company had obtained the consent of Parliament to reduce their standard to 14-candle power. But this was not enough. Perhaps the problem would not be solved until mantles could be supplied at a very low rate. The patent for this country had only a few more years to run; and they ought to pave the way by letting people understand that there was no longer any advantage in insisting upon a high standard of illuminating power for their gas if they were using incandescent mantles. The more they understood this, the better it would be. Of course, he was not arguing that gas companies should be relieved of any of the obligations to which they should be properly bound for the general benefit; but if, with the aid of public opinion, they could modify the views of Parliament, and were allowed to send out gas of a much lower lighting standard, the day was not far distant when the consumers would get gas for much less than 1s. 9d. per 1000 cubic feet. With this prospect before them, and new inventions coming to the front, they had nothing to fear, so far as it was possible to judge, from any competitor in the shape of electric light. That light had been tried in Plymouth, and, without reference to its quality, he thought Plymouthians were quite agreed that, as compared with the light which the Gas Company could supply by the

aid of incandescent appliances, it was far too costly to come into general use. A still further step had been taken within the past few months in connection with public lighting, and lamps had now been designed which would furnish a light equal in intensity to that of an electric arc lamp at half the cost. So it was quite clear that the gas industry was not going to stand still; and progress was the order of the day, both with regard to illuminating power and for heating and cooking purposes. Before concluding, he desired to say a few words upon the lack of combination among gas companies. Of all the industries in the country, that connected with the supply of gas was the one in which there was the least competition between the various members of it. Gas companies really did not oppose each other in any centre. There might be some little competition in London between them; but, taking the companies throughout the country, they were working the same business practically upon the same lines, and there was really no competition. Why, then, should they not form themselves into one gigantic Association for mutual defence, and for bringing pressure to bear upon Parliament? The thousands of gas shareholders in the country counted for something in these days of votes; and if a policy were agreed upon as being good and proper for the public as well as for proprietors, there was a power there that might be exercised upon properly organized lines, and would be of immense benefit. Much good might also be done by an organization of this kind in encouraging original research and new inventions for the improvement of gas lighting. One found inventors who were unable to carry out experiments through lack of apparatus or want of means, which they ought to have placed at their disposal; and if such an Association as he had suggested could be formed, one of the first steps should be the establishment of a first-class laboratory, maintained by the gas companies of the country—and a very small contribution from each would be quite enough—placing at the disposal of inventors and engineers means for carrying out experiments which gas companies themselves even did not possess at their individual works. At a central laboratory, the fullest facilities for experiments could be provided; and the profit would go to the gas companies as a whole, in the improvement of the article they had to sell. He felt satisfied that, following in the footsteps of Germany—where brains were paid for, and brought more and more into every class of business, and where chemists taken into the chemical industry were selected for their original research—the greatest benefits could be obtained in this country, if they had some such institution as he had suggested, where interchange of ideas could take place. Of course, they had the annual conferences of gas engineers, which were valuable indeed; but there was no workshop where the ideas suggested could be put into practice, or be put through the experimental stage. The important results which would ensue from a combination of gas companies for mutual defence would well repay the efforts and trouble that might be taken to form such an Association. As representing, if not one of the biggest Gas Companies in the country, at all events one of the oldest and most successful, he might be pardoned for throwing out these ideas; but he did think the time had come when, with strong competitors in the field against them, some combination should be brought about for the protection of their mutual interests.

The DEPUTY-CHAIRMAN (Mr. J. Wills) seconded the motion, and it was carried.

The CHAIRMAN then moved that a dividend of 5⅜ per cent. be paid on the ordinary stock, and corresponding dividends on the "additional" and "new" shares, less income-tax.

Mr. R. SMITH asked if the income-tax was to be deducted from the dividend, and said that if this were so it would just balance the increase made possible by the 3d. reduction in the price of gas.

The CHAIRMAN agreed that this would be the effect of the deduction of income-tax. For many years the Company, together with other companies, paid income-tax for their shareholders, and did not deduct it. The legality of this practice had been questioned in several quarters; and the Directors thought it desirable to take Counsel's opinion, and also to consult some of the largest gas companies in the kingdom. In the result, they came to the conclusion that the practice must be dropped At the same time, he ought to point out that it did not mean absolutely the loss of the money. It depended, after all, on what proportion the income-tax bore to the dividend they had been accustomed to receive; and they were not always going to pay a tax of 1s. 2d. in the pound.

The resolution was carried, as was also one authorizing the payment of the interim dividend in January next.

The retiring Directors and the Auditor were then re-elected; and the proceedings closed.

WELSBACH INCANDESCENT GAS-LIGHT COMPANY.

The Directors' Report.

The report of the Directors of the above-named Company was issued on Monday last week, in view of the ordinary general meeting next Thursday. In the course thereof, they state that there were increases of 75 per cent. and 46 per cent. respectively in the number of burners and mantles sold for the year; nearly a million burners and upwards of 8 million mantles having been sold—totals which exceed any previous annual output. The sales for the year ended March 31 showed an increase in amount over the previous year; but such increase was insufficient to yield the gross profit needed to produce an income from trading equivalent to that of 1899-1900. The gross profit was £122,792, against £159,029 for the preceding year. After adding the amount brought forward—viz., £3747—there is a total to the credit of the profit and loss account of £90,209. After charging Directors' fees, allowance to the trade, and depreciation, the balance of profit and loss is £70,035, which, after providing for interest on debenture stock, leaves an available sum of £66,002; the net profit for the year being £62,254. The dividend on the Company's holding of shares in the Austrian Company for the year amounts to £65,451, against £76,555 before. Out of the former sum, the Company's demand for fluid for their British trading contributed a very large proportion. The amount of profit for the English business for the year was seriously affected by (*a*) the special allowance for the trade on their stocks acquired before, and the expenses due to, the reduction in prices, £10,817; and (*b*) the further depreciation of materials in stock, £5785. There was also a decrease of £11,104 in the dividend on the shares in the Austrian Company. These sums taken together make a total of £27,706. The Directors recognize that the profits of the year's trading in Great Britain are of a disappointing nature. This result is due, they say, to special circumstances, and has followed the policy of the large reductions in prices, the effect of which must necessarily fall heavily on the year's trading in which they are initiated. There are also exceptional charges written off this year's accounts. It follows that revenue has been diminished by these special causes; so that the full effect of the new policy can only be exhibited in future years' trading, when such temporary charges upon revenue will have disappeared. The past year undoubtedly saw the greatest extension of the incandescent system of lighting yet witnessed. The Directors recommend that the balance of £66,002 shall be carried forward; the money being required for the further development of the business, including the building of new works. The existing factories having proved inadequate, the Directors have acquired a building lease for 99 years of a convenient site of 4½ acres at Wandsworth, and have contracted for the erection, at an estimated eventual cost of £25,000, of a half-section of new and commodious factories. The sum of £20,000 was paid during the year to the vendors of the Kern burner (British) patents, under the terms of the agreement to purchase; and since the making up of the accounts, a further sum of £20,000 has been handed over, which completes the entire purchase consideration of these patents—viz., £80,000. In the previous report, the shareholders were informed that the Company had guaranteed for a period the payment of the interest on the debentures of the Kern Burner Company, Limited, formed to work the Kern burner patents for certain other territories than Great Britain, and of which the Welsbach Company hold the ordinary shares. The Directors announce that the guarantee has now been cancelled, and any liability on this account has terminated. Under the arrangement by which this was effected, the Welsbach Company have had issued to them, in return for cash and advances made with interest thereon, and in payment for goods supplied, rent, &c., £15,000 of debentures of the Kern Burner Company, forming part of a total issue of £115,000. The arrangements include the granting by the Welsbach Company to the Kern Company of a licence for Great Britain under the Kern patents (and improvements made thereon by M. Charles Clamond, whose co-operation the Board much appreciate) as applied to heating, at an annual royalty, automatically reducible in proportion to the amount of dividend paid by the Kern Company on their ordinary shares. The number of Kern burners sold during the past year showed a considerable increase, and the adoption of the burner for pressure lighting has been accomplished in a highly successful manner, as shown by the installation in the grounds of the Glasgow Exhibition, which has been described as the finest display of gas lighting ever seen in this country. This should, the Directors think, tend to increase the popularity of the burner, in which an important improvement has been effected by two of the Company's Engineers, by means of which it becomes self-intensifying, and capable of yielding a light of about 300-candle power from a single burner without the aid of any auxiliary pressure apparatus. On July 17, 1900, the Directors entered into an agreement for the purchase of the entire undertaking of the New Sunlight Incandescent Company, Limited, with whom they had been in litigation for a considerable period. The purchase-money was satisfied in part by the issue of £110,000 5½ per cent. debenture stock of the Company, forming no charge on the property, and as to £3500 in cash in respect of the Knöfler patents for incandescent mantles for Great Britain, now the Company's property. Part of the assets purchased have since been vested in the New Sunlight Incandescent Company (1900), Limited, the capital of which is held by the Welsbach Company, and which the Company are otherwise financially assisting. The Directors report, in conclusion, that during the year Mr. James Head and Mr. Herbert B. Praed were elected Directors, and that the following resignations had been received: Mr. W. Harris, Mr. Herbert B. Praed, Mr. F. de la Fontaine Williams, Mr. Charles L. Samson, and Mr. H. L. Peters. One Director (Mr. A. J. Bethell) retires by rotation, and, being eligible, offers himself for re-election; but the Board do not recommend such re-election. They have decided to recommend that the number of Directors should for the future be reduced to five.

OLDHAM CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The Superintendent of the gas and water undertakings of the Oldham Corporation (Mr. Arthur Andrew) has prepared, with the assistance of the Borough Accountant (Mr. J. F. Lees), the annual statement of the year's operations at the gas-works. The total expenditure on capital account for the year ending the 25th of March is put down at £11,883. The gross revenue amounted to £177,523; and the expenditure to £160,864—the balance carried to the profit and loss account being £16,659. The annuities amounted to £3401; interest on loans and stock to £8340; and the sum payable to the respective sinking funds was £4334—the net profit being £583. One year's interest accrued to the annuity redemption fund, transferred to the profit and loss account in accordance with the provisions of section 30 of the Act of 1886, amounted to £628; and the balance brought forward from the previous year was £17,744. The Corporation were entitled to £9604 in aid of the borough fund; and this left a balance of £9351. The gas supplied free to the street lamps and municipal buildings amounted to 70,411,000 cubic feet. The increase in the price to Oldham consumers during the year by 3d. per 1000 cubic feet, due to the enhanced cost of coal, produced an addition of £10,760 to the gas-rents, compared with the year 1899-1900. The receipts from the sale of tar, however, decreased by £2835; and the drop in the amount received for liquor was £179. In regard to the fittings account, there was a credit balance from the previous year; and including this there will be handed over to the Finance Committee profits amounting to £775. The street

lighting account showed a deficiency for the year of £97. The trial of the incandescent system of street lighting having proved satisfactory, a further extension of it was made during the year. The quantity of gas manufactured was 1,243,384,000 cubic feet, compared with 1,239,927,000 cubic feet for the previous year. The bulk of coal and cannel carbonized in the production was 125,945 tons; 9872 cubic feet of gas being made from each ton. The loss of gas from leakage, &c., was 85,739,000 cubic feet, or 6·895 per cent. of the entire production. There was actually sold to consumers 7,765,500 cubic feet less gas than the previous year; the reduction being largely due to the enhanced price of the illuminant, and the lessened demand in mills and workshops owing to trade depression. The number of consumers in the borough is 50,148.

GLASGOW CORPORATION GAS DEPARTMENT.

Engineers' Salaries Increased.

At a Meeting of the Corporation of Glasgow, last Wednesday, the Gas Committee recommended that the salary of Mr. W. Foulis, the Gas Engineer, should be advanced from £1250 to £1400 per annum; and that the salary of Mr. A. Wilson, Manager of the Dawsholm Gas-Works, should be increased from £550 to £650 a year.

Mr. R. M. MITCHELL, the Convener of the Committee, moved the approval of the recommendations.

Mr. STEWART proposed that the Corporation should withhold approval. They were, he said, face to face with a deficit of £60,000 or £70,000 on the gas undertaking for the past year, and he considered they should not grant any increases of salary.

Mr. MITCHELL, having been called upon for information, said the Corporation had the best Gas Engineer in the United Kingdom, and one who was so regarded by his colleagues in the profession. When first appointed, Mr. Foulis's salary was £700, and he received his last advance in 1889. Since then the work in the Gas Department had increased by leaps and bounds. They were now in course of erecting the largest gas-works in the kingdom. Mr. Foulis had done all the work in the preparation of plans for these works, and had thus saved the Corporation the cost of a consulting engineer. Besides, there was no person in the same position as Mr. Foulis who had so low a salary. It had been said that they had had a bad year, and that this was not the time to increase salaries. For that state of affairs Mr. Foulis could not be blamed. Indeed, he (Mr. Mitchell) believed that on this account Mr. Foulis was entitled to the increase, because the very fact of the unfortunate position he was in would cause him to give greater attention, if possible, to his work. Whatever increase was proposed had nothing to do with the past year's working, inasmuch as it would not begin till the end of the financial year; and he hoped this year's working would show a different result. The Manager at Dawsholm was an excellent man. Mr. Foulis had the greatest confidence in him; and he thought they were proposing a very moderate increase.

Mr. H. ALEXANDER said that they were spending a million of money at Provan, and they would have thought they had made a very good bargain if they had got an engineer to carry out the work at 2½ per cent., which would have amounted to £25,000—a larger sum than Mr. Foulis had received since he became their Gas Engineer.

The recommendations of the Committee were adopted by a large majority.

WIGAN CORPORATION GAS SUPPLY.

The Past Year's Working.

According to the report of the Gas Engineer of the Wigan Corporation (Mr. Jos. Timmins), there was an increase of 928 consumers in the past financial year, or 9·33 per cent., compared with the twelve months ending March 31, 1900; of 413 prepayment meters, or 317·69 per cent.; and 191 cookers, or 22·23 per cent. The coal and cannel carbonized amounted to 34,492 tons, against 32,462 tons before, or 6·25 per cent.; and the make of gas was 382,225,000 cubic feet, against 369,465,000 cubic feet—a difference of 12,760,000 cubic feet, or 3·45 per cent. The quantity of gas sold was 354,744,800 cubic feet, compared with 343,809,300 cubic feet—an increase of 10,935,500 cubic feet, or 3·18 per cent. The revenue from the sale of gas (as shown by the accounts of the Borough Treasurer, Mr. W. T. Wanklyn) was £53,671; residuals produced £17,251; and the total receipts were £72,563, against £66,322. The expenditure was £47,493, compared with £38,335; coal costing last year £22,853, against £15,960. The balance carried to the profit and loss account at the close of the year was £25,070; whereas on March 31, 1900, it was £27,987. Returning to Mr. Timmins's report, the net profit last year is shown to be £11,107; bringing up the total profit for the past fourteen years to £135,706. The cost of coal and cannel in the year ending March 31, 1900, was 9s. 10d. a ton; while the revenue from residuals was 8s. 1d.—making the net cost 1s. 9d. In the past year, however, the figures were 13s. 3d., 10s., and 3s. 3d. Taking the fourteen years, the averages shown are 10s. 2·4d., 6s. 11·86d., and 3s. 2·53d. The consumption of gas for public lighting amounted last year to 41,006,000 cubic feet, against 39,792,400 cubic feet in 1899-1900; being an increase of 1,213,600 cubic feet, or 3·04 per cent. The extent to which gas is used for cooking, heating, and motive power is shown by the following figures: Cooking and heating, 31,260,900 cubic feet; motive power, 10,042,600 cubic feet—together, 41,303,500 cubic feet, being an increase of 5,022,200 cubic feet, or 13·81 per cent. The gas used for the above-named purposes represents 11·61 per cent. of the total sales. The capital invested in the undertaking at the close of the year amounted to £344,071—being £9 19s. 6d. per ton of coal, &c., carbonized, 18s. per 1000 cubic feet of gas made, and 19s. 4d. per 1000 feet sold; the interest charges came to £9195 7s. 2d., or 5s. 3·977d., 5·774d., and 6·221d.; and the sinking-fund charges to £4725 3s. 4d., or 2s. 8·876d., 2·967d., and 3·197d. Mr. Timmins concluded by expressing the hope that the results of last year's working will prove satisfactory to the Committee, more especially if taken in connection with the great increase in the price of fuel and labour. The former was 3s. 5d. per ton compared with that of the preceding year, which on 34,494 tons represents £5892 14s. 6d.; and the latter—3¼d. per ton of coal and cannel carbonized—represents £467 for the year. He again thanks the Committee for the cordial support and encouragement he has at all times received from them; and bears testimony to the loyal co-operation of those of the staff who are associated with him in the general conduct of the various operations of the Gas Department.

DUNDEE CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The Annual Statutory Meeting of the Dundee Gas Commissioners (now incorporated with the Town Council) was held last Tuesday, when the accounts for the past financial year were presented.

Treasurer RITCHIE, in submitting the accounts, said it was a matter of much regret that they were not of a more satisfactory nature. The estimated revenue of the Gas Department was £120,609, whereas the actual amount was only £114,986; bringing out a deficiency of £5623. Gas yielded less by £4298, and chemical products by £2424—together, £6722; while coke, &c., gave more by £1099 than the estimate. The total gas sold was 562 million cubic feet, against the estimate of 583 millions—being a decrease of 21 million cubic feet. The estimated expenditure for the year was £120,554, and the actual expenditure £123,639, showing an increase over the estimate of £3085; these sums combined (less the estimated surplus) brought out a deficiency of £8653. The principal increases were on coal, main and service pipe repairs, retorts and setting, fuel, and refuse. He had asked the Engineer (Mr. W. M'Crae) to go carefully into these increases, and explain how they arose. The following were his explanations: "Coal.—(1) The increase was due partly to coal of inferior quality, and also being compelled to work retorts which only gave indifferent results; (2) the stokers were also given an increase of wages after the estimates were made up, thus adding to the cost of coal. Main and Service Repairs.—The increase here was largely due to repairs having to be effected on the pipes in consequence of tramway operations. Retorts and Setting.—After repairs had commenced, it was found necessary to do more than was originally intended. Fuel.—In winter the refuse coke was found to be insufficient for furnishing the steam required, and good coke had to be used in consequence. Refuse.—This increase was accounted for by the continued long cartage required for the disposal of same." The decrease in revenue arose from a smaller quantity of gas being sold, as well as a lower price being received from chemical products. During the current year, they expected to manufacture 612 million cubic feet of gas; this being the actual quantity last year. The estimated revenue from all sources was £108,839, and the estimated expenditure £108,029; showing a surplus of £810. It might, however, be asked how it was possible to clear off the debit balance and reduce the price of gas by 4d. per 1000 cubic feet, which they proposed to do. The answer was very simple—viz., because they were able to buy coal at a very much lower price than they paid last year. He had nothing more to say regarding capital account than he had said many times before—viz., that, in his opinion, it was by far too large. Personally, he should have no objection to retain gas at its present price for a year or two, so that this account might be brought more into line with the capital of other gas-works similar to their own. Dundee would within a very short time be in possession of gas-works thoroughly up to date, fitted with every modern appliance for making cheap gas. He had no hesitation in saying that the current year would be a testing-time for their management; and they hoped that every effort would be put forth to make the cheap manufacture of gas the success they anticipated. He moved the adoption of the estimates, and that the price of gas be fixed at 3s. 6d. per 1000 cubic feet to consumers in Dundee.

Mr. BALLINGALL seconded the motion. With reference to the last remarks of the Treasurer, he (Mr. Ballingall) was prepared to do everything he could, as a Convener who was not resident on the gas-works, to carry out the wishes expressed

Bailie STEVENSON argued that in slot meters and gas-stoves much better business might be done. At the present time there were 747 stoves out on hire, which was a small proportion when compared with Glasgow, which had on hire 18,000. In his opinion, £4000 was too large a sum to carry to the contingent fund; as £1500 for the year just ended, and £1500 for the current year, would have enabled them to take another 2d. off the price of gas, reducing it to 3s. 4d., and to keep the fund exactly as it should be kept—viz., ready for any contingency that might arise. If they could not get rid of their debt, members might get rid of the indifference which they manifested to gas matters.

Mr. HIGH said that in the estimates they found that on coal alone they were saving £15,277. They were also told that they would have the finest up-to-date gas-works, which would enable them to produce cheap gas. They had heard this fairy tale for a long time; and he was now glad to learn that it was an assured fact, which would enable them to reduce the cost of carbonizing by 2s. per ton, and thus save £7000 on this head, or a total saving of £21,764. Allowing £8600 for the deficit on their accounts, it would still leave them about £15,000 to come and go upon, which would enable them to reduce the price of gas by 7d. or 8d. In the face of all these circumstances, they were only going to reduce the price by 4d. They would, however, also reduce the illuminating power from 23 to 20 candles. It was of no use to blind the public in this way. They were reducing the price of gas virtually nothing, notwithstanding that the saving of £15,000 to which he had referred permitted them to take 7d. or 8d. off the rate.

Mr. BROWNLEE thought they must not grumble at the cost not being further reduced. There had been a debit balance of £8000, equal to something like 4d. per 1000 cubic feet. They were reducing the price by 4d., which altogether, keeping in view the deficit he had named, was equivalent to a fall in price of 8d. per 1000 cubic feet. His only fear was that, unless there was a further drop in coal, they would not

have a credit balance at the end of the year; and, of course, it was impossible to speculate upon that.

Bailie CRICHTON expressed the hope that, with improved appliances, there would be a reduction in the cost of carbonizing. As a Gas Commissioner, he wished to be assured that in future such precautions would be taken as to ensure that inferiority of coal supplied at the gas-works would be checked at the time, and would not run on until they had no power to make a claim on the contractors.

Mr. BALLINGALL said that under the new conditions they would be in a position to make three tests a day; and with the additional railway siding accommodation, they would be able to inspect on the spot coal as it came in, and deal with defaulters from week to week.

Treasurer RITCHIE said no one regretted the shortage more than he did; but he did not think blame attached to the Commission. Last year, it had to be remembered, they were in a state of transition; and the condition of the market was such as to make the Manager hesitate to reject coal, lest he should not get sufficient for his purpose.

The motion was then agreed to.

Lord Provost HUNTER proposed a vote of thanks to Treasurer Ritchie, who, he said, was a very safe financier. If the Commission only followed his lead, they would soon, he believed, get out of all their difficulties.

Bailie MELVILLE, having been informed that the Sub-Committee recently appointed would be responsible in future for all coal contracts, said he was glad to hear it, because now the Manager would be perfectly clear of that matter, and would be able to devote his energy and time to the production of gas and the building of new works.

Mr. BROWNLEE wished to know when the new retort-house was to be put in operation. This, he said, was an important point, in view of the fact that the Treasurer had based his estimates on the new retorts being at work on the 1st of July.

Mr. BALLINGALL said in about a month everything would be ready.

COVENTRY CORPORATION GAS ACCOUNTS.

In the "JOURNAL" for the 4th inst. appeared a few figures regarding the accounts of the Coventry Corporation Gas Department for the past financial year. The full report of the Committee is now to hand; and we give it as follows: The total revenue for the year from all sources, including sales of gas, coke, tar, &c., amounts to £86,091. The expenditure for coal and all other materials, wages, repair and maintenance of works, &c., totals to £76,136. This leaves a gross profit of £9955, to which is to be added the interest on reserve fund, £130, and amount carried forward from last year, £1497; making a total of £11,582. Against this are capital charges amounting to £11,253, leaving a final balance of £329, which the Committee recommend should be carried forward to the next account. During the year the following sums have been expended on capital account: Lands acquired (including law charges), £5027; new building and plant, £287; new mains and service-pipes, £1922; new meters, £1045—total, £8282. Of money raised by the Corporation by the issue of 3 per cent. redeemable stock in December last, £113,203 was on account of the gas undertaking, and of this £53,703 was applied in paying off existing loans—leaving £59,500 new capital. The nominal amount of stock representing this sum of £113,203 and expenses of issue is £122,879. The total borrowing powers exercised since the acquisition of the gas undertaking amount, with nominal additions, to £306,692, of which £31,340 has been repaid out of the sinking fund; leaving total liabilities amounting to £275,352. Against this the Corporation have reserve and sinking funds amounting to £9156—leaving a balance of liability of £266,195. At the meeting of the City Council last Tuesday, Mr. R. A. Rotherham presented and moved the adoption of the report. In doing so, he remarked that trade had been bad, and this was the general explanation of the decrease of profits; but £9459 more had been spent in the production of gas, coal cost £10,028 more, and there had been increases in wages, oil, and mains. In the result, there was a loss, after allowing for capital charges, &c., of £1167. The Committee did not propose to further advance the price of gas, and he saw no reason why the department should not soon revert to the old happy state of being "the goose that always laid the golden eggs." Alderman Tomson moved an amendment to refer back the report, so that part of the current expenditure on mains might be charged to capital, and some income thus released in relief of rates. Mr. Lee, in seconding the proposition, remarked that it was a very sad state that Coventry was in, when the department on which the city relied for an annual net income had a loss. Alderman Marriott held that the price of gas ought to have been raised more than 2d. per 1000 cubic feet. The amendment was rejected by a small majority, and the report adopted.

GAS AND ELECTRIC LIGHTING AT BURTON.

The Past Year's Results—The Question of Sunday Labour.

The Burton-upon-Trent Town Council had before them at their last monthly meeting particulars in regard to the gas and electric light works, which are under the supervision of Mr. F. L. Ramsden. The sale of gas in the year ending March 31 produced £38,926; street lighting, £4637; meter and stove rents, £951; residuals (coke, tar, and lime), £11,583; sulphate of ammonia, £2202; and fittings and sundries, £776—making a total of £59,075. In the preceding year the sales of gas brought £32,322, and the total revenue was £49,629. In the past year, the Corporation paid £32,732 on account of carbonization, coals costing £27,723, against £19,336—a rise of £8387—and the total expenditure was £52,679, compared with £43,108; the profit for the two years being £6396 and £6521 respectively. Mr. Lowe, in moving the adoption of the Gas Committee's minutes, remarked that, as the accounts had been forwarded to each member of the Council, it was not necessary for him to go into them in any detail. The working of the Electric Light Department had been disappointing to him. The sales had increased by more than £500; but this sum had been almost entirely swallowed up by increased expenses. Although they showed a profit of £115, this would not have been the case had they taken up the loans. However, they hoped for better things in the future. No doubt when the demand had considerably increased the works would be remunerative. The gas profits would go in reduction of the rates. There was a growing feeling in the town that the Committee should do something to reduce Sunday labour at the gas-works. Up to a short time ago, the stokers worked seven shifts of eight hours each per week for five weeks, and then on the sixth week they worked only six shifts of eight hours, making one Sunday off every six weeks. They all felt that if this could be altered without great loss to the town it was very desirable. It was generally agreed that the physical labour all the year round, particularly stoking, at the gas-works was not likely to conduce either to the material or the moral development of the men. He explained the scheme of the Committee, whereby Sunday labour would be reduced during the summer, but remarked that when the winter came round it was probable they would not be able, in a six-day week, to make enough gas for seven days with the present plant. Therefore it would be necessary during the depth of winter to revert to Sunday labour, though they hoped, as far as possible, to be able to reduce it to a minimum. About a month ago they arranged for the stokers to stop for eight hours on Sunday. They increased this to sixteen hours; and the arrangement would be continued as long as possible. As to the cost, no doubt the alteration would add to the manufacturing expenses; but it would not be a heavy addition. Mr. Roberts seconded the motion. Mr. Hutchinson called attention to what he considered a grave injustice to the gas consumers. He complained that, after they had presented the town with the gas-works, they were charged a high price, of which the electric light consumers had the benefit. He thought the time had come when the practice of taxing one portion of the community for the benefit of another should be discontinued. Mr. Rowland remarked that the proper time to make a protest against the gas profits going to the relief of the rates was when the budget was presented; and if the question were then raised, he should be glad to help on any course that would enable them to arrive at a decision as to what was a fair amount to be given in relief of the rates. Mr. Lowe, in reply, said he did not think the price of gas was exorbitant, and if the Finance Committee intimated that they did not want any money from the Gas Committee, the Committee would not keep up the price just for the sake of doing so. However, it had been decided by the Committee to reduce the charge 3d. per 1000 cubic feet as from the 30th inst.

The minutes were passed.

BURSLEM CORPORATION GAS ACCOUNTS.

The annual accounts of the Burslem Gas Department have been laid before the Town Council. In moving their adoption, Mr. Edmund Leigh, the Chairman, said the make of gas was 210,785,000 cubic feet, as compared with 199,147,000 cubic feet the previous year, or practically an increase of 10 million cubic feet. The private consumption was 129,209,000 feet through ordinary meters, and 33,580,000 feet through prepayment meters. It was interesting to notice the steady increase in consumption through slot meters. When these meters were first introduced, some people made light of them, and expended on them a great deal of humour, which was more or less worthless. It was, however, a striking fact that they had taken a great hold; and the Corporation now disposed of about a fifth of the total output to users of slot meters. In 1898 the quantity of gas delivered through slot meters was 14,536,000 feet; in 1899, 20,396,000 feet; in 1900, 25,543,000 feet; and last year, 33,580,000 feet. Public lighting had taken rather more this year—about 20,400,000 feet; and 2,807,150 feet had been used on the works. About 25 million feet had to be written off as unaccounted for. One of the most unsatisfactory features in connection with the undertaking was the loss from leakage. Last year he had ventured to express the hope that they would reduce the figure; but he was sorry to report a considerable increase on that account. This item was the one blot upon the gas-works account. They had had some serious leakages in various parts of the town. Mains had to be carried over bad land; and when subsidences occurred the mains were broken, and it was difficult to discover the actual point of leakage. Some time ago they had a serious explosion in the town. A very heavy load had been carried over the road; and the gas had escaped from the broken main and percolated through the ground. They had to meet a claim for compensation, in addition to standing the loss of a large quantity of gas. There were at present in use 3453 slot meters, as against 3227 ordinary meters—an increase of 550 slot meters and a decrease of 220 ordinary ones. The gross receipts for the year had been £36,494, as compared with £28,910 in the previous year. They had received for gas, less discounts, £26,618, as against £20,811 last year. During the present year, they had eliminated meter-rents, which last year amounted to £526. Had they not abolished that source of income, about £750 might this year have been realized in rent for meters and stoves. From residuals £9022 had been obtained—an increase of £2400. Taking the expenditure, for coals £14,928 had been spent, as against £8256 in the preceding year—an increase of £6672 5s. 3d. He asked the Council to note that the increased revenue for gas did not cover the increased cost of coal, notwithstanding the change in prices. They had received £5800 extra for the gas, and paid an additional £6672 for coal. On maintenance there was a saving of £1699; and on meters and mains there had been £2182 more spent than in the previous year. They had been charged £293 for rates and taxes—an increased figure which they could hardly take exception to. The total expenditure was £36,488, showing a surplus of £5 6s. Mr. Leigh went on to point out that for some time they had not charged for public lighting; and the Committee estimated that, had a charge been made, there would have been £2600 to come from that source. On the whole, the result was one the Committee could congratulate themselves upon, subject to the serious loss from leakage. Steps had, however, been taken to have the district thoroughly examined with the view of preventing waste as far as possible. It had been a matter of great anxiety to him during the year that, though they had been charging more for the gas, they had been paying an enormous increase on coal, and getting inferior sorts. The

figures showed that, although they had paid more than double the price of three years ago for coal, they had not been able to make the same amount of gas per ton at the higher price. The Committee were prepared to do their best in the interests of the undertaking. But there were threatening aspects; and it seemed that they were not going to have a very easy time during the coming year. Mr. Owen seconded the motion, which was carried.

INCANDESCENT GAS v. ELECTRICITY FOR STREET LIGHTING.

At the Sixth Annual Convention of the Incorporated Municipal Electrical Association held in Glasgow last Wednesday, under the presidency of Mr. W. A. Chamen, Chief Electrical Engineer to the Corporation, Bailie W. Maclay, Convener of the Electricity Committee, read a paper on "Street Lighting," in which he discussed the relative values of incandescent gas and electricity for this purpose. He remarked that, whatever else electricity might have accomplished, there could be no doubt that since its advent in 1880 there had been a steady and rapid improvement in the standard demanded for street illumination. There was nothing to show that for main thoroughfares, where a really brilliant illumination was desired, incandescent gas could in any way equal, far less surpass, electric light. A great deal had been made of the assertion that electric lighting was "patchy," giving a brilliant illumination within a certain radius from the lamp and a comparatively poor light at points midway between; and great efforts had been put forth to show that, by converting the ordinary flat-flame gas-burners into incandescent mantle lights, the illumination was much more evenly distributed, although it might not be so intense at points near the lamps. This, however, had been investigated by electrical engineers, and it had been found that an equal standard of lighting—measuring the light at points midway between the lamp-columns—could not be obtained in this manner, except by using such a number of incandescent gas-mantles that the cost would be more than that of electric lighting to give the same result. So far, it would seem that incandescent gas lighting in streets was not unlikely to have the same result as it had had in house lighting. It had been observed, by those in a position to know best, that the ordinary consumer of electric light went through three stages —first, ordinary gas; second, incandescent gas; third, electric light. For this reason, electricity supply authorities could not but welcome the improvement over ordinary gas which the gas-mantle promised.

In the course of the discussion which followed, Bailie Mackenzie, of Edinburgh, said he agreed with all that Bailie Maclay had told them, except with regard to his criticism of their gas friends. He did not think it was conducive to pleasant working in municipal life that two departments should be at variance. While he wished the gas undertaking all success, he did all he could to further, in a legitimate manner, the interests of electric light. In Glasgow they had had large experience of electric light, and he understood that they were going ahead pretty fast. It was a question of money. If the community wished to bring in electric light, and were prepared to pay for it three times the cost of gas, they would get it. He thought he interpreted the opinions of municipal men in general when he said that corporations were prepared to pay the additional expense of having electric light in the main thoroughfares; but, much as he wished the electric light to succeed, he would not, as a municipal representative, be prepared to advocate so much lighting of side and unimportant streets. The cost of the lamps in Great Western Road was quite £500 per mile per annum. With the introduction of the electric tramways, this was quite necessary, but it could not be said that £500 was a reasonable charge for small streets. Alderman Pearson (Bristol) said he was substantially in accord with Bailie Maclay's views. His experience of the natural growth was that it began with an ordinary gas-burner in lighting and advanced to the incandescent mantle. When this mantle smashed at an inopportune moment, as mantles generally did, the user approached the Electricity Committee with a view to obtaining a supply. Bailie Finlay (Glasgow) said he had no doubt that when people came to realize the advantages of electricity in their houses the electric light would hold the field. In Glasgow they had only a few hundred lamps. If they had a thousand in their main thoroughfares it would lend a great impetus in the direction of lowering the price to the people. A vote of thanks was accorded to Bailie Maclay for his paper.

COAL LIGHTERAGE ON THE THAMES.

Suggested Employment of Unlicensed Lightermen.

The Royal Commission appointed to inquire into the management and accommodation of the Port of London resumed their sittings last Tuesday, at the Surveyors' Institution, Great George Street, Westminster—Lord Revelstoke presiding. In the course of the sitting, Mr. George Livesey was called as a witness. He stated that the South Metropolitan Gas Company had joined in the promotion of the Thames Lightermen's Bill of this session. They used about 1,200,000 tons of coal a year; three-fourths of which was delivered direct from the steamer into the works, while the rest was barged to those works to which ships had not access. The supply must be maintained at all costs and risks. If the lightermen struck, other men must be employed, regardless of the question whether or not they were licensed. This happened in December, 1889, when the gas stokers struck, and the coal porters, the lightermen, and the seamen and firemen did likewise, without notice, in sympathy with them. The Company had to fill their places as best they could. They promised (and the promise was kept) permanent employment to all suitable men who stood by them through the difficulty. In the case of lightermen, the Company found other work for those who were unlicensed. Witness considered that the late most unjustifiable strike of lightermen was due solely to the fact that only licensed men could be employed. Had it not been for this, the men would not have struck; but, knowing that their places could not be filled, they felt they were safe. They knew fresh men could not be engaged, and that their places must be kept open for them till they chose to return to work. This alone was a most complete condemnation of the system. It was even bad for the men themselves; and it was on this ground that the Company joined in the promotion of the Bill. Although their lightermen did not strike, and worked contentedly all through, the Company suffered serious loss and injury. Whenever a section of men in a trade did not join the strikers, special notice was taken of them and their employers. The men who helped the Company during the strike, especially those who were engaged on the river, were exposed not merely to continual hooting and insult, but to absolute danger by the strikers; and the Company's property was also damaged in every possible way. During the late strike, eight of their loaded barges, which were securely moored off the works at Vauxhall, were cast adrift. Two were sunk, and the greater part of the coal lost; another was carried against a bridge pier, and was only saved from sinking by running aground. The remainder were picked up by a friendly tug. The men who worked the tugs were not licensed watermen. The loss to the Company from this piece of mischief was about £400. Being responsible for their barges (they had nearly 100), they were bound to exercise care in the selection of lightermen. Of course, as required by law, they employed only licensed men. But the licence of the Watermen's Company was not considered any recommendation. In fact, they did not regard it, but selected their men quite independently, for their general capacity and trustworthiness. The Company had three tugs. On the captains and their men lay the real responsibility of navigating the river, as the barges never went alone. They were always towed; consequently, the lightermen had little or nothing to do with the navigation. But the Company were free to choose men from all the world to work their tugs. They asked that there should be similar freedom in the case of lightermen. If this were granted, the existing licensed lightermen would not suffer, provided they were trustworthy and capable men; and such men would undoubtedly secure priority of employment.

CORK GAS STRIKE AND EXPLOSION.

The delay in coming to a decision in the prosecutions against the gas workers who went out on strike at Cork is unsatisfactory. One case against a man named Foley was heard some weeks since; and judgment has not yet been delivered by the Magistrates. But they proceeded last Tuesday with the hearing of evidence in the case of another old retort-house hand named Driscoll. The Manager (Mr. J. Magrath) testified that the action of the men in going out on strike necessitated the suspension of public lighting entirely and the private lighting partially. He was cross-examined rather severely for the purpose of showing that he claimed the right to summarily dismiss men; but he denied this, excepting in cases where the men misconducted themselves, were incapable, or did not do their work properly. The former Manager (Mr. T. P. Travers) appeared among other witnesses. He stated that at no time during his management was there an agreement in writing with the men; they depended on practice. While the witness was Manager, the men complained of the employment of a non-Society man. They then said they would go out on strike unless this man was dismissed. Witness refused to dismiss the man, and told them that he would require a week's notice of their intention to leave. He heard no more about the matter. At the close of the Company's case, there was a great deal of deliberation on the part of the Magistrates, who afterwards announced that they were anxious to obtain information as to the usage in the gas-works at Dublin and Waterford, and a few English towns. During the hearing, it was pointed out by the Company's legal representative that, as he had no fresh evidence to give, it would be useless proceeding with the other cases until he knew the decision of the Magistrates in the two already heard. Further proceedings were then adjourned for a week.

At a meeting of the Cork United Trade Association on Thursday, one of the members asked what was the object of the Board of Trade in deferring an investigation into the cause of the explosion at the gas-works? An insinuation had been made that innocent men were responsible for it; and he should like to know why the matter was not cleared up before now. The President proposed—"That this Trade and Labour Council, representing the workers of the city, demand the fullest inquiry into the recent explosion at the gas-works, with a view of seeing who is responsible for it, and to prevent anything similar recurring in the future." The motion having been seconded, an Alderman said the public had the right to demand the inquiry. A claim for upwards of £2000 had been lodged by the Gas Company against the city; and he thought the question was not altogether so much one for the trade and labour bodies as for the general public. He suggested that the matter should also be raised by the Municipal Council, and that the corporate body should request the Home Office to order an inquiry at once. The resolution was adopted; and the last suggestion was approved.

At the meeting of the Corporation last Friday, Alderman Cave asked whether there had been any report from an expert of the Board of Trade on the explosion at the gas-works. He thought, in the interest of the ratepayers, they should demand such a report. Did the Corporation propose to take any action in the matter? The Town Clerk said he directed the City Engineer to visit the place. He did so; and, on a cursory look, he came to the conclusion that the explosion was not malicious. Alderman Cave remarked that this was very satisfactory. The Town Clerk added: He says that the tank was never properly constructed; and his idea is that the portion where the gas escaped was thin and could not stand extra pressure. The only thing he could not account for was the flame; and he thought this might have occurred through some man smoking his pipe. I shall write to the Board of Trade pressing them to send over an expert, because it will be all expert evidence. If dynamite had been used, the indent would be in, and not out; and the City Engineer could not discover any such indent.

According to the "Pall Mall Gazette," a bullfinch has built its nest in a large incandescent gas-lamp in one of the main thoroughfares of Harrow.

ELECTRIC TRAMWAYS AND ELECTROLYSIS.

The Select Committee of the House of Lords of which Lord Pirbright is Chairman commenced on Monday last week the consideration of a Bill promoted by the Finchley and Hendon Tramways Company to obtain power to construct two lines of tramways, to be operated by electricity on the overhead trolley system, from Golder's Green—the one to run to Hendon, and the other to the boundaries of Finchley. It was explained by Mr. Freeman, K.C., in opening the case for the promoters, that the tramways were designed to form, together with the proposed extension of the Charing Cross and Hampstead tubular railway to Golder's End, a continuous and expeditious through route between Hendon and Finchley and the heart of London. The petitioners against the Bill included the Middlesex County Council, whose opposition was principally based upon the desire to themselves construct the lines, and the West Middlesex Water-Works Company, who alleged danger to their pipes and mains from electrolytic action, and asked for further protection. The whole question of electrolysis, Counsel said, had been raised this year in the case of a Bill promoted by the Corporation of Sheffield, where the matter was discussed before a Committee; and finally a clause was inserted which had been adopted in other Bills this session. This clause (*ante*, p. 829) it was proposed to embody in the present Bill. In several cases, however, it had been refused by Parliament; but the promoters were prepared to offer it to all the Companies concerned along these routes. It had satisfied the Gaslight and Coke Company, the New River Company, and everybody except the West Middlesex Water Company; and he asked their Lordships to apply the clause in their case. After taking evidence in support of the Bill, the Committee adjourned till the following day, when Mr. Pember, K.C., on behalf of the Company, said there had been a certain amount of conflict in the two Houses on the matter of electrolysis, and no special clause for the protection of water companies' pipes had been allowed in the House of Commons, but one had been granted in the House of Lords. The Water Companies did not think it was sufficient for their protection. The whole question of electrolysis in connection with tramways was, however, being fought out before a Committee of the House of Commons on the London United Tramways Company's Bill, where all the Water Companies' representatives were able to be present, as all their pipes were concerned; and the West Middlesex Company, acting on his advice, had thought it better not to further contest the matter before their Lordships' Committee. They would therefore not continue their opposition, but would reserve their right unimpaired to take what steps they thought fit in the Lower House when the Bill reached there. Mr. Freeman said the Sheffield clause was fought out before a Committee who heard a considerable amount of expert evidence; and it was the outcome, up to the present, of the wisdom of Parliament. The opposition of the Middlesex County Council having been met, the preamble of the Bill was passed.

LARGE ELECTRIC POWER STATION ON TYNESIDE.

Gas Company and Electric Company Co-operate.

Last Tuesday an important step was taken in the direction of furnishing a supply of electricity for power purposes on Tyneside, by the formal opening at Wallsend of a large station which has been constructed jointly by the Newcastle-upon-Tyne Electric Supply Company, Limited, and the Walker and Wallsend Union Gas Company. It is, we believe, the first undertaking of the kind in this country; and it is interesting to note that two Companies who might not unnaturally be regarded as rivals have been associated in carrying it out. The station is located on a site at Neptune Bank, Wallsend, and is fully equipped with all machinery necessary for generating and transmitting power on a considerable scale. At present, plant of 5000-horse power is installed; and before the end of the summer this figure will be doubled—the design of the station being such as will result in economy of operation and reliability of service. Steam is supplied by means of Babcock and Wilcox water-tube boilers, furnished with mechanical stokers and superheaters, and working at a pressure of 200 lbs. to the square inch. The flue gases, after passing away from the boiler, are carried through a Green's economizer, in order to utilize as much of their heat as possible, and thence they pass up the chimney, which is of steel, lined with firebrick, and is 150 feet high. The main engines are each of 1400 indicated horse power, and of the triple-expansion type. They run at 100 revolutions per minute; and, in addition to the ordinary governors, they are furnished with emergency ones, so arranged as to shut off the steam absolutely should the speed by any chance reach 115 revolutions. The electric generators are of the British Thomson-Houston Company's manufacture. They are of the revolving field magnet type, and generate three-phase currents at a pressure of 5500 volts. In addition to these large dynamos, the station is, for purposes of local lighting and power supply, equipped with continuous-current machinery; the engines driving it being each of 300-horse power. Two main switchboards are provided—one (the high-tension) dealing with the current generated at 5500 volts; the other controlling the continuous-current dynamos, which work at a pressure of 240 volts. The three-phase current generated is first conveyed from the dynamos to the switchboard, and thence to the cables running to sub-stations in the various manufacturers' works. These cables consist of three copper cores separated from each other by means of paper strips soaked in resin oil. The whole cable is then covered with a continuous outer coating of lead, which serves to protect the paper from moisture. The pressure of 5500 volts has been adopted in order to enable the current to be transmitted to long distances. Among the large works already supplied with power from Neptune Bank are Messrs. Armstrong, Whitworth, and Co.'s Walker shipyard, Messrs. Wigham, Richardson, and Co., the North-Eastern Marine Engineering Company, and the Northumberland Shipbuilding Company—each taking from 400-horse power upwards. In these yards electricity is applied under widely different conditions and to all kinds of machine tools; and it has resulted in doing away with long lengths of wasteful steam-piping, as well as with much unnecessary belting, and thus greatly minimizing the transmission losses. In some cases motors of the continuous-current type are used; in others, they are of the three-phase induction type, which has not yet been largely adopted in this country.

The inaugural ceremony was performed by Lord Kelvin at a luncheon served in the Drill Hall, Walker, at which Sir Andrew Noble presided. The guests travelled by special train from Newcastle to Carville, whence carriages conveyed them to the power station, after inspecting which they proceeded to the Northumberland Forge, to visit the North-Eastern Marine Engineering Company's works and the sub-station which supplies electric energy to them. From there they went on to Willington Quay, to inspect the electric installation at the works of the Northumberland Shipbuilding Company, and then made for the Drill Hall. In the course of his remarks after luncheon, Sir Andrew Noble pointed out that in respect of many of the great inventions of the past century this country had not advanced as America and the Continental nations had done. He agreed with Cobden that for the Government to make articles which could equally well be supplied by private manufacturers was a gross mistake, and would ruin the country. He feared the tendency of corporations to get manufacturing power into their own hands, and to place restrictions upon private manufacturers. Manufacturers should be left as free as possible. So far as electrical enterprise was concerned, it had been hindered by parliamentary enactments. Lord Kelvin, in declaring the premises open, said they were going to distribute electric power from a central station to distances ranging from ¼ mile to 3½ miles. In the works of the North-Eastern Marine Engineering Company and in those of the Northumberland Shipbuilding Company the visitors had seen two of the chief systems employed in power distribution. To the former it was transmitted at 4500-horse power, and reduced by the subsidiary station to 240; while the Shipbuilding Company employed the three-phase system as being more useful for the varied machinery used. Having pointed out that the new station would furnish power in from the highest to the lowest form, as well as direct current for lighting, Lord Kelvin remarked that up to the present England had been behind the Continent and America in the use of electricity; but the opening of that station was likely to bring us into line with them in its utilization by means of the various systems available.

ELECTRIC LIGHTING NOTES.

Utilizing their loan of £35,000, the Keighley Town Council, last Saturday week, had the satisfaction of seeing the start of their electric light enterprise. The works at present contain three dynamos and engines of 200, 200, and 300 horse power respectively; but the works are built for an eventual increase of plant up to 3000-horse power. Alderman B. S. Brigg, in the course of the opening ceremony, recalled what he characterized as the wise enterprise of the old local authority in establishing, three-quarters of a century ago, almost on the same site, their successful gas-works.

A loss is shown in the accounts of the electric light undertaking of the Coventry Corporation for the past year. The receipts amounted to £6054, and the working expenses to £4515—leaving a balance of £1539. The capital charges are £3789, so that there is a loss on the year of £2250. The trading was unfavourably affected by the greatly increased price of coal. The number of customers has increased from 226 to 331 during the year, and the 8-candle power lamps connected from 17,806 to 23,637. The number of units sold has increased from 229,607 to 341,810; and the revenue from the sale of current and meter rental, from £4188 to £6053. The increase in units sold to private consumers has been from 169,056 to 268,982; and the revenue from this source is £5120, against £3500.

At the last meeting of the City of Dublin Electric Lighting Committee, tenders were accepted which involved the completion of the city lighting scheme. The Committee decided to recommend the Corporation to accept four tenders for the remaining sections—totalling to £60,566. The sum which the Corporation had previously sanctioned for the entire electric light installation amounted to £265,661; but tenders for the whole scheme had been placed at a sum of £246,189. To this must be added an estimated amount for engineers' fees, &c., of £13,000—making a total of £259,000. So that it will be seen that the Committee entrusted by the Corporation with the management of this important department of civic enterprise, a local paper remarks, has actually completed all their contracts at £6000 under the estimated amount.

The electricity supply undertaking of the Wolverhampton Corporation does not show up so well as some of the members no doubt desire. After payment of interest and sinking fund, there was a deficiency on last year's working of nearly £131. A change from high tension to the three-wire system is accountable for an outlay of £546; the average price obtained per unit has been less by ½d.; and the price of fuel has been high. These are the causes which combined are stated to have produced the adverse result. But one would have thought that an increase of 26 per cent. in the number of consumers, of 34 per cent. in the number of lamps connected, and of 31 per cent. in the units sold would have had a counterbalancing effect. Where the Committee would have been without these increases, perhaps they do not care to contemplate. When the accounts were before the Council a few days since, one of the Aldermen unkindly asked why the light went out the other night; and, he added, "We do not always get the best quality of gas, but we can always rely upon gas of some sort." The reply to the question was that an armature broke.

The Wakefield City Council have had a long discussion on the question as to whether they should raise the salary of their Electrical Engineer (Mr. Blackmore) to the modest sum of £300 per annum, and in connection with extensions give him 1 per cent. on all completed work on capital account. The salary proposed is not an exorbitant one for a man who is capable of saving the Corporation, as Mr. Blackmore it is admitted has done, something like £4000 to £6000. But as to the 1 per cent. commission, the displeasure of the Local Government Board may be incurred if the Corporation are not careful as to where they take the money from. It may be remembered that recently, in granting an electric lighting loan to the Wolverhampton Corporation, the Board

particularly stipulated "that no payment must be made out of the loan to any salaried official of the Town Council," except in the case of payments, if any, due to the Town Clerk for legal work not within his ordinary duties under the terms of his appointment. However, the Wakefield Council have agreed to both the increased salary and the commission, though the latter was strongly opposed.

"The predictions made have not been verified." These words were used at the last meeting of the Yarmouth Town Council by Mr. Brown in connection with the electric lighting undertaking; and it was the annual report which provoked them. This showed that in the past year the income was £7225; and the working expenses £5406—leaving £1819 to pay interest, sinking fund, &c., amounting to £2570. There is thus a deficiency of £750. Mr. Brown's remarks, which followed the moving of the report, are worth recording. He said the members were entitled to have an explanation as to this loss of £750; and he was surprised the Chairman of the Electric Light Committee had not offered a word of excuse. They were told in the report that one reason was the rise in coal values, and another that the price of the electric light was reduced; but why, he asked, did the Committee not increase the charge as gas companies had done theirs? It could not be done now, because coal had fallen, and gas companies had reduced their price. He had raised this point in Committee, but found no one to support him. Whoever had been responsible for the electric light reports to the Town Council had been far too optimistic. The predictions made had not been verified; and he could not understand how the Committee could have been so misled by these estimates, for the reports were nothing more. If a proper and fairly accurate report had been brought before the Committee, he would have had support when he proposed to raise the price of the electric light. The reports he condemned as Micawberism of the most pronounced type. It came to this, that rich people who could afford to use the electric light were enabled by the contributions of the ratepayers to have it at less than cost. Moreover, in Gorleston and Southtown they did not have the electric light at all. The past year's working had been disastrous; and he hoped it would not be used as an argument against the tramways. Dr. Ryley remarked that the waste of electric light in the town was enormous. Mr. Martins, Chairman of the Electric Light Committee, said the increased cost of coal, combined with a reduction to consumers, had completely upset all their calculations as to profits. In an ordinary year, he believed a good profit would have been earned. Alderman Wiltshire observed that the town was no doubt a gainer by having more light; but the electric light needed looking after very closely. The report was then confirmed.

GLASGOW CORPORATION WATER SUPPLY.

Opening of a New Aqueduct.

On the occasion of the annual inspection of the Loch Katrine Water-Works by the Glasgow Corporation last Friday, a new aqueduct was opened which vastly increases the supply of water to the city. The first aqueduct from Loch Katrine to the service reservoir at Milngavie is 25¾ miles in length. It is 8 feet wide and 8 feet high with arched roof, and is capable of discharging 40 million gallons of water per day. The second aqueduct, which runs almost parallel with the first all the way from the loch to the service reservoirs, is 23½ miles in length. It is 12 feet wide and 9 feet high, with arched roof, where it is not lined with concrete; and 10 feet wide and 9 feet high, with arched roof, where it is lined; and it is capable of discharging 70 million gallons per day. The two aqueducts, taken together, are capable of discharging 110 million gallons per day into the two service reservoirs, which are distant about seven miles from the city. The construction of the new aqueduct has occupied from March, 1886, to June, 1901, or fifteen years. The Mugdock reservoir has a water surface of 62 acres and a capacity of 500 million gallons; and the Craigmaddie reservoir has a water surface of 88 acres and a capacity of 700 million gallons. Combined, these reservoirs contain 24 days' supply at the rate of 50 million gallons per day. There are four lines of 36-inch pipes from Mugdock, and two lines of similar pipes from Craigmaddie. The water from Loch Katrine is not filtered; being merely strained through fine wire gauze netting. The cost of the new works is as follows: Reservoir, £316,600; aqueduct, £730,640; outlet works and raising the loch, £40,731; lands and compensation, £93,727; engineering, £31,582—total, £1,213,280. The new mains from Craigmaddie cost £116,126.

The Peoria Electrolysis Litigation.—We learn from the "Engineering Record" that Mr. Frank L. Wean, special Master in Chancery, has filed with the Clerk of the United States Circuit Court in Chicago his report in the famous Peoria electrolysis litigation, which has been in progress for about three years. The Peoria Water Company sought an injunction against the local Electric Railway Company to compel them to substitute a double-trolley system for the single-trolley one now in use. The basis of the claim was the destruction of the water-mains by the return currents, which has been very noticeable in Peoria for many years. The Company have won a complete victory in the Master's report, which recommends granting the injunction, and awarding damages for past destruction to their property. Our contemporary says this case has been noteworthy in the amount of expert testimony introduced by both sides, and for the time taken in the hearing and the preparation of the report just filed. This document must now come before the Judge on a final hearing before he approves it; and it is understood that an appeal will be made from his decision to the Superior Courts by the losing litigant, as both parties have announced their determination to leave no chance of success untried. If the Master's report is eventually upheld, it means the introduction of important changes on most of the electric railways in the country. In support of the statement as to the extent of the evidence, we learn that Mr. Adolphus A. Knudson, of New York, whose investigations into the effect of electrolysis have been noticed in our columns, was retained in the case, and was employed almost continuously during the summer and autumn of 1899 in obtaining evidence, &c.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of the Company was held last Thursday, at the Offices, Commercial Road, Pimlico, under the presidency of Mr. F. S. Clayton.

The Secretary (Mr. G. H. Gill) read the notice calling the meeting, the certificate of the Government Auditor, and the report of the Company's Auditors.

The Governor, in proposing the adoption of the report, said he thought that the proprietors would all be of opinion that it was of a satisfactory character. In these days of reduced dividends, it was gratifying to know that their undertaking, at all events, notwithstanding that it had been handicapped by increased expenditure, had been able to hold its own; and he believed it to be in as safe and secure a position financially as it had ever occupied. The gross income for the half year ended March 31 last amounted to £88,878, being an increase of £2072 over that of the corresponding period of the previous year; while the working expenses amounted to £30,162, showing an advance of £2665, of which, however, nearly £2000 had been caused by the abnormally high price of coal. In the result, the Directors had had no hesitation in recommending the same dividend as that declared for the last half year—namely, at the rate of 11 per cent. per annum. The dividend had been earned in the six months, and £531 was carried forward on the half year, or, taking the twelve months, the amount was £3284. In addition to this, the Company had a reserve of £41,251, or, including the contingency fund, £52,170. The proprietors would therefore feel that he was justified in saying that the concern was in a strong financial position. The capital expenditure during the half year had been £3520, which was made up of £2140 paid to the contractors on account of the new service reservoirs on Putney Heath, and £1380 for extensions of service mains, &c., in the district. They had further payments to make in regard to the service reservoirs at Putney, and for raising the banks of the reservoir at Molesey—namely, the usual 10 per cent. which was kept in reserve for twelve months after the contract was completed. These payments would amount together to £7700. The cost of pumping showed the large increase of £1935, which was owing almost entirely to the exceedingly high price of coal. He was, however, happy to say that the Directors had just entered into a fresh contract for coal at a considerable reduction of price, so that the accounts for the next two half years might be expected to show a substantial saving under this head. There had been 292 new supplies laid on during the half year, which were estimated to produce an additional water-rental of £1563; while 135 houses had been pulled down for improvements, entailing a temporary loss of income of £293. Some 1474 yards of service-mains had been laid to meet extensions in the district, principally in Fulham. This was new business, which was always profitable. Since their last meeting, the Company had had the misfortune to lose their Engineer, Mr. Richard Hack, who served them for fifteen years, performing his duties most conscientiously. To succeed Mr. Hack, the Directors had appointed Mr. A. A. Gill, who had been for eighteen years in the Company's service, during the last sixteen of which he had filled the post of District Engineer. The Bill for the purchase of the Water Companies, introduced into Parliament by the London County Council, was rejected on second reading in the House of Commons. At the same time, the President of the Local Government Board announced his intention of bringing in a Bill next session to deal with the London Water Question. The usual notices would no doubt be received in November; and he believed that the Bill would be in print probably by December. The Directors hoped that the arbitration clauses in the Government Bill would, at all events, be of a fairer character than those in the Bill of the London County Council. The Board were, as usual, incurring considerable expense in opposing Bills in Parliament; but the outlay was necessary, as without such opposition the Company would probably suffer severely. Since the last meeting, the Metropolitan Water Companies had prepared a set of regulations respecting fittings for the prevention of waste and other purposes. These came before the Local Government Board for approval, and that body opened an inquiry into the question. At the inquiry, however, there was manifested the most determined opposition on the part of the London County Council and other public bodies; and, in the end, the Directors of all the Companies thought it was advisable to withdraw the regulations, in the face of the opposition, and for the purpose of saving expense. The action of the London County Council in this matter was somewhat inconsistent, because that body already had power to require water consumers to have proper fittings, and also, if necessary, to provide the fittings at the cost of the consumers. He might say that the regulations prepared by the Companies were brought in practically at the suggestion of Lord Llandaff's Commission—in fact, in the report of that Commission the Companies were blamed for not having brought them in sooner. The Companies had hoped that the inquiry would have taken place in the latter part of last year; but unfortunately the Local Government Board postponed the matter till just on the eve of the County Council election, and the question was made a party cry. The consumers must not imagine that they would be let off more easily under a Water Authority than they were by the Companies as regarded the question of fittings; it was well known that a Water Board would deal much more stringently with the subject. The quinquennial re-valuation was now complete; and he was sorry to say that the assessment of their mains and works had been considerably augmented. They had a set-off in increased rates arising from the re-assessment of the houses; but it was not equivalent to the advance in the rates and taxes. The first payment to the City Chamberlain would be made shortly after the July dividend, and it would amount to about £2000. He might mention, in this connection, that in the report of Lord Llandaff's Commission the following remark was made: "The so-called sinking-fund clauses are peculiar to modern water legislation; and no other trading company has been put under similar restrictions." The fact was that the clause was first introduced in 1886 into a Bill of the East London Water Company, on the ground that the purchase of the undertaking was imminent. There was the irony of the position. Ever since, on the same plea, the clause had been introduced into every Bill which the Companies had promoted for raising further capital; and the injustice still continued. He might

remind the proprietors, in conclusion, that there was a daily analysis of the water supply of each of the London Companies by Sir W. Crookes and Professor Dewar, who reported most favourably on the purity of the water; while recently they stated that the result of their bacteriological examinations could only be characterized as excellent.

The DEPUTY-GOVERNOR (Mr. Jackson Hunt) seconded the motion.

Mr. E. T. E. BESLEY, K.C., after expressing gratification at the continued prosperity of the Company, asked whether it was possible for the Directors to avoid going for an Act next session—looking to the fact that there seemed to be no capital available.

The GOVERNOR, in reply, stated that the Board had no intention, as at present advised, of going to Parliament next year. He thought it would be very unwise to do so, in face of the announcement made by the President of the Local Government Board of his intention to introduce a Bill dealing with the question of the Metropolitan Water Supply. The accounts showed that the Company had an unexpended balance on capital account of £17,051, which would suffice for the next three or four years for their ordinary outlay on extensions, mains, &c.

The motion was then carried unanimously; and resolutions were afterwards passed approving the dividends recommended on the preference and ordinary stocks, and re-electing the retiring Directors and Auditors.

Sir H. B. POLAND, K.C., in acknowledging his re-election as a member of the Board, desired to point out that the analyses of the water supplied to London which were made by Sir William Crookes and Professor Dewar were made in their own way, and entirely independently of the Companies; and having regard to the high position of those distinguished Chemists, their reports must be accepted as correct. In addition, there were the analyses which were made by Mr. Thorp on behalf of the Government; and in that gentleman's report (dated May) for the month of April, the Chelsea Company were favourably spoken of, not only with regard to the quality of the water supplied by them, but also as to the amount of storage which they possessed.

A vote of thanks to the Governor and Directors brought the meeting to a close.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Corporation of Glasgow have this week advanced the salary of Mr. W. Foulis, the Gas Engineer, and of Mr. A. Wilson, the Manager of the Dawsholm works, the former from £1250 to £1400, and the latter from £550 to £650. It is a pleasant thing to see merit recognized; and the pity is that these recognitions were not given ungrudgingly. The consolation is, however, that in corporations there are always some whose ability to see things as they are is not what it should be in the case of men elected to public positions. No matter how wisely or well matters may be conducted, there will always be cavillers. On this occasion, it is true, the cavilling was not on the ground that the advances in salary were undeserved, but that, the times being bad, the Corporation could not afford them. In this connection, it was given ou that there is a deficit on the working of the gas undertaking during last year, of £60,000 or £70,000. The explanation was advanced by Mr. Primrose that this could scarcely be called a deficit, as the Corporation had resolved to face a deficiency rather than raise the price of gas. The amount of the deficiency was also questioned. Nothing, therefore, can be said upon the subject, further than that it has been learned, fully a month before the usual time, that a deficit has arisen, the amount of which is not known, but that it was not unexpected. The Corporation have had deficits before, the largest of which was in 1891-92, when it amounted to £27,116. The next year, however, wiped it out, and left a surplus of £29,539; this being effected by the raising of the price of gas by 3d. per 1000 cubic feet. What may be done this time will depend largely upon the price at which coal will be bought. Though it does not affect the situation, it may be pointed out that Mr. Primrose's explanation was not wholly correct, because the Corporation did raise the price of gas last year by 4d. per 1000 cubic feet, making it 2s. 6d.; but when the addition was made, it was stated that it ought to have been 6d. Reverting to the increase to Mr. Foulis, my feeling is that it is not sufficient, when the magnitude and importance of the work he is engaged upon are taken into account. As it is, it places him in the position of being, in the matter of salary, the leading gas engineer in Scotland, which he has long been as matter of fact The "bad year"—a plea which will probably be heard of again—was urged against a proposal to raise the maximum salaries of the meter inspectors and clerks; and it was used with such effect that the Convener of the Gas Committee (Mr. R. M. Mitchell) agreed to take the subject back for reconsideration.

The annual accounts of the Dundee Corporation Gas Department, to which I have already referred, were before the Town Council as Gas Commissioners on Wednesday. In the nature of things, there being a deficit of over £8000, it was to be expected that there would have been some wriggling on the part of the section of the Council who are not official at the present time; but, indeed, that condition is one which is chronic in the Dundee Corporation. The Montagus and Capulets of that body are in perpetual feud over public matters, and especially over the gas undertaking. Some might say there is need of a strong man at the head of affairs in Dundee, who would be able to fuse the opposing forces into one, and direct their energies for the common good, instead of their being dissipated in resisting each other. But, on reflection, it must be recognized that such a state of matters would be the reverse of beneficial to the rest of the universe, for there are so many men of great intellectual power in the city that a combination of them would be irresistible, and other communities whose interests should happen to conflict with those of Dundee would go to the wall. There is quite a crowd of ex-Provosts in Dundee; and I say again, as I have said before, that the community of Dundee would benefit immensely if they could persuade the men who occupy the civic chair to retire into private life when their term of office expired. Ex-Provosts are apt to criticize with too much force the policy of their successors; and, as a result, they either intimidate a successor from bringing forth his best, or they, with their following, thwart him if he does. It is several years ago since Treasurer Ritchie proposed to improve the position of the finances of the gas undertaking by strengthening the contingent fund. Ex-Provost Brownlee has never approved of the step; and this year he brought forward the criticism that the contingent fund was being used for the reduction of capital, and not for true contingent purposes, and, further, that the sinking fund was being used as capital, and interest charged upon it. It is a matter of pure finance. If the Treasurer thinks it is cheaper to use money in hand than to borrow, so long as he does nothing illegal, he is free to do it. He can borrow money at any moment, to replace this; and the risk he runs is that he may require to do it at an awkward time. The practice of the Treasurer may be good or it may be bad, theoretically; but whether it be good or bad practically, is a matter which should not admit of doubt. It is not said that it is bad practically; and therefore I conclude that the criticism is captious, and, consequently detrimental to the interests of the gas undertaking. It is said that the accounts are kept in a way that is mysterious—that they cannot be understood. I cannot say as to this, never having seen them; but I observe that Treasurer Ritchie has promised that another year the accounts would be so stated that "anyone could understand them." The manner in which the accounts are kept is only a form; the substance is what is brought out at the end of the year. In this respect, there has been no reason for complaint in Dundee; and the circumstance that the past year was a bad one is not to be taken into account, for it was so all over the country. Yet we have the threat thrown out—by another ex-Provost, too—that the question of management would be taken up next year, unless there was a considerable saving of money. It is not a side-light on their actings, but a fierce *exposé* of the quality of this body that, on the same day when this expression was uttered and uncontradicted, the Council were informed that a Sub-Committee had been appointed who would in future be responsible for all gas contracts; and one of the Magistrates expressed his pleasure at this arrangement, because it would leave the Manager perfectly clear of the matter, and would enable him to reserve his energy and time for the production of gas and the building of new works. That is to say that, at the end of the year, the Manager is to be held responsible for the results obtained from materials which he is to have no say in selecting. Is there another corporation anywhere who would seek to throw the burden of their own bickerings on to the head of an official, as they seem to be doing in Dundee? I observe that a Committee has been appointed to prepare a report as to the time when the contracts for the new works should have been finished. This is on account of the delay which has been experienced. If the Commissioners ever travelled beyond Dundee, they would be aware that works all over the kingdom have been delayed, for reasons which would not be mentioned; and therefore a Committee is unnecessary. To impose penalties upon contractors who have had to face the impossible, would not be wise policy. We shall see if it will be recommended in Dundee.

The annual accounts of the Perth Corporation Gas Department were adopted, on Monday, and the price of gas was, by 14 votes to 9, reduced from 3s. 6d. to 3s. 4d. per 1000 cubic feet. Mr. Watson, the Convener of the Committees, said that their affairs had been very satisfactory during the past year. They increased the price of gas from 3s. 2d. to 3s. 6d.; and the revenue from gas was £27,596, or £4298 over the previous year. The quantity sold was 159,833,400 cubic feet, or an increase of 11,127,870 cubic feet. The rental derived from gas-stoves had increased by £193, coke and tar by £1573, and other products by £344. The total revenue was £33,660, as against £27,247, an increase of £6414. Coal and benzol cost £125 more than the preceding year, wages had increased by £334, and salaries by £25. Repairs and maintenance were less by £248; and meters and fittings were more by £118. The balance carried to net revenue account was £8302, as compared with £5205. On the whole, Mr. Watson thought that, considering the exceptional and somewhat difficult year, the amounts were very satisfactory; and with the new works in operation, the coming twelve months should be much more easy, so that higher and better results might be anticipated. In making up their estimates, they wished to be on the safe side; and while the working of the electric light could only be approximately estimated, they had the security that if the consumption of electricity went up and the consumption of gas went down, or *vice versâ*, their revenue would be secure from one of the sides. Mr. Macpherson, on the grounds that they had removed to new gas-works, where they had still to gain experience, and that the gas revenue must be affected more or less by the introduction of electric lighting, moved that the price should remain at 3s. 6d. As stated above, the Commissioners resolved to reduce it.

It was reported to the Peterhead Town Council this week, that the quantity of gas made during the year was 24,255,600 cubic feet, an increase of 2,687,500 cubic feet over the previous year. The amount of coal carbonized was 2518 tons, and the average price 22s. per ton. In the year preceding the quantity carbonized was 2159 tons, and the average price 18s. 3d. per ton. Although the price of coal was higher, the rates charged for gas were not increased last year from 4s. 3d. per 1000 cubic feet for lighting and 3s. 9d. for cooking, heating, and motive power. This was chiefly due to the improved yield from residual products, resulting from the use of new plant. The amount received for residuals was £1162, equal to 9s. 2d. per ton of coal carbonized, as compared with £581, or 5s. 4d. per ton in the preceding year.

The Earlston Gas Company, in the fifth year of its existence since reconstructed, earned a profit of £128. A dividend has been paid at the rate of 3s. 6d. per share; and the balance has been placed to the suspense account, which now stands at £184. The price of gas has been reduced to 5s. 10d. per 1000 cubic feet. The Edzell Gas Company's business last year resulted in a deficit of nearly £8, which, added to a debit brought forward, makes the balance against the Company now about £32. The price of gas is continued at 7s. 6d. per 1000 cubic feet. The Pitlochry Gas Company have paid a dividend of 2½ per cent., instead of 5 per cent. as hitherto. The price of gas has been retained at 7s. 6d. per 1000 cubic feet. A new retort-house is to be built. The Cambuslang Gas Company had a balance of £1732, out of which a dividend at the rate of 7½ per cent. has been paid, £200 added to the reserve fund, and £182 carried forward. It has been resolved to borrow £2000, to meet the cost of the erection of additional plant at the gas-works and the laying of a new 12-inch main.

The new batch of litigations which the Welsbach Incandescent Gas-Light Company, Limited, have instituted in Scotland, are, I am informed by Counsel, a fresh departure on the part of the Company, in respect that, although they have had numerous actions against alleged infringers, they have never yet attempted to establish the validity of their patent of November, 1893. All previous actions have been under the 1886 patent, except that against A. Krumm, of London, which was brought under both the 1886 and the 1893 patents. As will be seen from the report of the proceedings in Edinburgh (see p. 1757) the point in dispute is whether, the claim in the 1893 patent including a small proportion of cerium in the composition of the mantle, and there having been cerium in the mantles made under the 1886 patent, the 1893 patent was not anticipated. The old question of the validity of the 1886 patent is raised in an action against the United Chemical Company, which is said to be awaiting hearing in London. The question of the validity of the 1893 patent is raised in these five Scotch actions, which have also been sent for trial. In both London and Edinburgh, therefore, attempts are being made to set aside the Welsbach patents. The issues are complicated by the fact that Krumm, after having been restrained from selling mantles, and having disregarded the injunction and been sent to prison, has apologized to the Welsbach Company for having infringed their 1893 patent. This circumstance, along with the certificate by Mr. Justice Channell in the Krumm proceedings, that he had considered the validity of the patent (which is equivalent to saying that it is valid), makes the task which the Scotch respondents have taken upon themselves a very difficult one, because at the start of the proceedings this certificate will be tabled. It will be maintained that the validity of the patent of 1893 has been established, and that the only question to try is the one of fact—whether mantles of a certain composition were sold. It will take some argument to get over that.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 22.

Sulphate of Ammonia.—The market has been somewhat irregular in Scotland, full prices being paid to makers, while second-hand parcels have been offering at a discount. Elsewhere the tone has been quiet, though parcels offered have met with a fairly ready sale. The closing quotations are £10 5s. per ton f.o.b. Hull, £10 10s. f.o.b. Leith, and £10 11s. 3d. f.o.b. Liverpool. There has been more interest in the forward position; but sellers' and buyers' views have been too divergent to admit of much business. London (Beckton terms) is quoted £10 15s. per ton for delivery up to the end of the year; while £10 17s. 6d. per ton, ordinary terms, would probably be accepted by Scotch makers. Buyers' views are about 5s. per ton below these prices.

Nitrate of Soda is firm on spot at 8s. 9d. to 9s. per cwt. for ordinary and refined qualities respectively.

LONDON, *June* 22.

Tar Products.—There is very little fresh to report as regards the market. Crude carbolic continues to fall in value. Business is reported in 60's at 2s. 3½d. per gallon, while consumers now offer only 2s. 3d. It is difficult to understand the position of this article, as crystals are decidedly better; and there is an improved demand, especially for 34-35's. Tar oils are scarcely so firm, although there is a good demand, and with a decreased production an improvement is expected. Solvent is still very dull, and, with the exception of a few small orders for home consumption, there is nothing doing. As regards anthracene, there is nothing whatever to advise. The great depression which prevails in the alizarine trade renders consumers utterly indifferent as to this article for delivery during the present year. During the week, a few transactions have taken place in creosote salts, but principally in common qualities, for which rather low prices have been accepted. Pitch remains in the same position. There is an improved demand for consumption in South Wales; it being evident that several fuel makers are arranging their contracts for next season.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 30s.; west coast, 28s. Benzol, 90's, 8½d. to 10½d.; 50's, 8¾d. to 10d. Toluol, 11d. Crude naphtha, 4d. Solvent naphtha, 1s. to 1s. 1d. Heavy naphtha, 11d. to 1s. Creosote, 1¾d. to 1¾d. Heavy oils, 2¼d. Carbolic acid, 60's, 2s. 3d. to 2s. 3½d. Naphthalene, 65s. to 80s.; salts, 40s. to 50s. Anthracene, "A," 2½d.; "B," 2d. nominal.

Sulphate of Ammonia.—A continued depression has prevailed during the past week; and there has been some difficulty in arranging business. The Gaslight and Coke Company still quote £10 15s. But there are sellers of the Beckton make at £10 10s. for prompt delivery, while on Beckton terms it would be difficult to obtain £10 5s. Some small transactions have been reported at £10 5s. f.o.b. Hull; but there is not very much offering at this port. In Leith, it is reported that makers still hold for £10 10s.; but they find considerable difficulty in realizing more than £10 7s. 6d. The demand for shipment from Liverpool is not quite so strong; but prices are fairly well maintained at this port for prompt delivery.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although house-fire coals in the Lancashire district are fairly well maintaining their price—collieries either running short time or putting down stocks to meet the lessened demand which, of course, is usual at this time of the year—there is a good deal of competition with low-priced house coal coming in from other districts; while in the commoner descriptions of round coal, the cutting in prices is very keen. In fact, with regard to these there would seem to be no fixed basis at all—collieries arranging their prices according to circumstances. In some instances as low as 9s. per ton has been taken on contracts for anything like large quantities supplied to works; while for the locomotive fuel contracts, the Lancashire coalowners have also had to come down to 9s. per ton. Even at this figure the railway companies are

JOSEPH AIRD
GREAT-BRIDGE,
STAFFORDSHIRE.
TUBES
AND FITTINGS
GAS, STEAM, WATER GALVANIZED-TUBES, &c.
LONDON OFFICES: 46, QUEEN VICTORIA STREET, E.C.

not buying at all their usual quantities. Generally, the inland pit prices for steam and forge coal may be quoted as not more than about 9s. to 9s. 6d. per ton for ordinary qualities, with steam coals to be bought readily for shipment at about 11s. 3d., delivered at the Mersey ports. In gas coals, business is progressing steadily; and collieries have apparently not found it necessary to give way to anything like the extent they have done on other classes of common round coal, where the reductions have ranged from 4s. to 5s. per ton, in special cases, on the maximum prices obtained last year. So far, it has been quite exceptional where there has been any giving way in gas coal contracts beyond 2s. 6d. to 2s. 9d. per ton on the 1900 prices; but possibly there may be some competition for one or two of the larger contracts that have not yet been finally settled. The general basis of pit prices remains practically much the same as quoted last week—averaging 10s. to 10s. 6d. per ton for the commoner sorts, 10s. 9d. to 11s. for good medium qualities, and 11s. 3d. up to 11s. 6d. in some cases for the very best screened Wigan Arley gas coals. For engine fuel prices continue weak and irregular; and although there is perhaps not quite so much of the low-priced surplus slack being pushed on the market, owing to the shorter time worked at collieries—especially in one or two districts that have been chiefly competing here, such as Derbyshire, where some of the pits are not now running more than two days per week—there are still more than ample supplies to meet requirements. Buyers prepared to take anything like quantities for quick clearance, particularly in the commoner sorts, could purchase at exceedingly low figures. At the pit, common Lancashire slack remains at 6s. 6d. to 7s. per ton, with best qualities quoted at 8s. to 8s. 6d.; but good ordinary slack is still being offered from Derbyshire as low as 3s., and both Staffordshire and Yorkshire slack at considerably below local quotations. A generally steady tone is reported throughout the coke trade; but this is perhaps not due to any pressing demand so much as to lessened production and the withdrawal of the keen competition of Yorkshire coke, prices for which during the last week or two have gone up about 1s. to 1s. 6d. per ton. At the ovens, good washed Lancashire furnace cokes are firm at 12s. 6d. to 13s., with foundry cokes quoted at from 23s. and 24s. to 25s. and 26s. per ton at the pit, according to quality.

Scotch Coal Trade.—There are some large contracts in the market; and until these are fixed, the market will not visibly vary. Their determination will have an important bearing upon prices; but, in any event, there is likely to be a further drop. There is a plentiful supply of coal, and no indication of interference with that state of things. The prices quoted are: Main, 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 3d. to 10s. 6d. The shipments for the week amounted to 216,886 tons—an increase of 14,766 tons upon the previous week, but a decrease of 6600 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,163,333 tons—a decrease of 583,549 tons upon the same period of last year.

Northern Coal Trade.—There has been an increased demand for coal of all sorts the last few days. The demand for steam coals is steady, and the price is well maintained at about 13s. 6d. per ton f.o.b. Steam smalls are not quite so steady; but the output is well taken up, and the price varies from 5s. to 5s. 6d. per ton. In the gas coal trade, the taking of the Trieste contract at about 8s. 11d. per ton f.o.b., *plus* the coal duty, shows what is the view of prices under contracts for a little time ahead. In the case of gas coals for occasional cargoes, as high a price as 10s. 6d. per ton f.o.b. is quoted; there being a good demand for such cargoes for early shipment. The coke trade is steady; the export demand being very full, and the home consumption fairly an average. Best Durham coke is 17s. 6d. to 18s. per ton f.o.b.; while for blast-furnace coke the quotation is 15s. to 15s. 6d. per ton at the Teesside furnaces. Gas coke is now far from plentiful; but the demand is not very strong. The price quoted on Newcastle Exchange for gas coke for export is from 12s. to 13s. per ton f.o.b.

New Reservoir for Rochdale.—At the last monthly meeting of the Rochdale Town Council, the minutes presented by the Water Committee set forth that the New Works Sub-Committee had reported that, in accordance with a resolution of the Committee, they had considered the new works to be carried out under the Rochdale Corporation Water Act, 1898, and recommended that the necessary lands for the construction of a new reservoir below the present one in the Ramsden Valley should be acquired. It was also recommended that Mr. James Mansergh be retained to carry out the works authorized by the Act, and that the Sub-Committee be empowered to settle the terms of such retainer. Both recommendations were approved by the Committee, and adopted by the Council.

Sales of Shares and Stock.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale, by order of the Directors, a new issue of "E" £10 preference shares (5 per cent.) in the Aldershot Gas and Water Company, at an average price of £11 15s. 9d. per share, yielding the investor £4 4s. 10d. per cent. On the same day, Messrs. Herbert Morris and Son sold fully-paid £25 shares (7 per cent.) in the Lewes Water Company for £60 and £60 10s.; a share of like nominal value, but entitled to 10 per cent., for £69; and 24-25ths and 1-25th of a similar share for £67. A parcel of £20 of 5 per cent. preference stock in the Company fetched £29, and another of £30 realized £44. On Thursday, Messrs. Garrod, Turner, and Son sold £2000 of "C" stock of the Ipswich Gas Company, carrying 9 per cent. dividend, in lots of £10, at £21, £21 10s., £21 7s. 6d., and £21 12s. 6d. per lot. Mr. J. T. Jolliffe, the Company's Engineer and Secretary, was the purchaser of eight lots at the highest price. On the same day, 1500 additional £5 shares in the Portsmouth Water Company, forming part of the new ordinary capital authorized by their Order of 1898, were sold by Messrs. Smith, Sapp, and Wyatt. They were offered in lots of five, and the prices realized ranged from £7 down to £6 2s. 6d. per share. The total amount obtained was £9672, against £10,170 for 1500 similar shares sold two months since. On Friday, Mr. T. C. Woods sold 340 additional "E" shares of £20 each in the Northampton Gas Company at an average price of about £30. The total amount realized was £10,298 15s.

SAWER & PURVES.

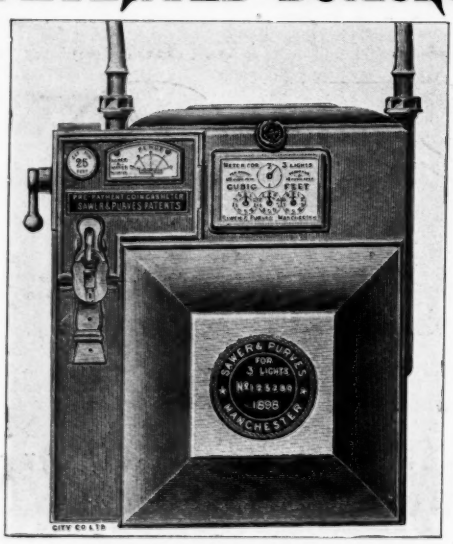
(BRANCH OF METERS LIMITED),

Telegraphic Address: "SAWER, MANCHESTER."
National Telephone: 3289 MANCHESTER.

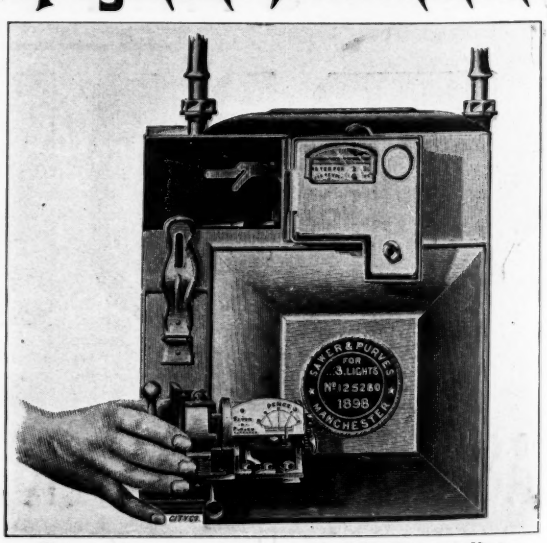
NELSON METER WORKS, MILES PLATTING,
MANCHESTER.

Makers of Meters fitted with

PATENTED Detachable Prepayment Attachment.



Meter in working position.



Meter with attachment removed without uncoupling.

Gas Explosion in Barcelona.—According to a telegram received through Reuter's Agency, a violent gas explosion occurred in one of the streets of Barcelona on the 15th inst.; the roadway being torn up in several places. The flames rose to the third storey of the houses; and 40 persons are said to have been more or less injured.

Lighting, Meter, and Gas Apparatus Company.—The last report of this French Company gives the following details respecting the gas portion of the undertaking. The Company have purchased the Lorient Gas-Works, which they hope to greatly develop by supplying fittings, &c., on hire. The Palaiseau works have been much enlarged; and the mains extended through neighbouring communes. During the past financial year, 38,244 frs. worth of hired appliances were installed, and on Dec. 31 last, all the orders received were far from being executed. Installations on the hire system were also numerous in the other districts; their value last year being 253,037 frs. This explains the increase in the sale of gas. With the same number of works, the consumption, which amounted in 1899 to about 123 million cubic feet, rose in 1900 to 134 millions.

Extensions at the Kendal Gas-Works.—Owing to the enormous increase in the make of gas during the past few years at the Kendal Corporation Gas-Works, it has been found necessary to extend the storage capacity; and a gasholder, 90 feet in diameter and 25 feet deep, has been erected. It is a telescopic holder, prepared for three lifts, and capable of containing 280,000 cubic feet of gas. The cost of the holder is £7500; and the contract is in the hands of Messrs. Clayton, Son, and Co., Limited. There is also in course of erection, by Messrs. C. & W. Walker, new sulphate of ammonia plant on the continuous system. An old gasholder has recently been converted into a storage tank for tar and liquor. The new holder has been erected from the plans of Mr. T. N. Ritson, Assoc.M.Inst.C.E., the Gas and Water Engineer to the Corporation.

Swindon Water Supply.—Mr. M. K. North, one of the Local Government Board Inspectors, held an inquiry last Tuesday, at Swindon, into an application of the Corporation to be allowed to borrow £3295 for the purposes of increasing the water supply. When Swindon was incorporated in November last, the Corporation took over the undertaking of the old Water Board; and they are now engaged in making certain additions which are called for by the great growth of the population in recent years. It is intended to spend £2600 in the provision of new water-mains; and, as showing the necessity for this outlay, the Clerk stated that since 1895 there had been 3170 new attachments. A sum of £210 is intended for the purchase of a plot of land, adjoining the present works, which is said to be full of springs, and capable of yielding 100,000 gallons of water per day of which the analysts speak in the highest possible terms; £180 is included as the cost of sinking a well and making the necessary connections with the mains; and a further sum of £300 will be expended in demolishing the eight existing filter-beds, and putting up in their place five sand ones on the lines of those at Reading, which it is estimated will deal with 100,000 gallons of water per day.

The Coal Export Duty.—It is announced that several foreign Governments recently made representations to the English Cabinet, through their Ministers in London, in reference to the imposition of 1s. per ton on exports of coal, and suggested that contracts already in force should be exempt from the payment of the tax. The "Politische Correspondenz" now states that it has received information from London intimating that the action taken in the matter has been successful, and that existing contracts will be excluded from the duty.

London County Council and Subways.—The Improvements Committee of the London County Council have submitted their annual list of county improvements in respect of which they recommend that parliamentary powers should be sought next session. They consider it will be desirable for clauses to be inserted in the Bill giving the Council power to require companies to place their gas, water, and other pipes inside any subway or subways which may be constructed in connection with these improvements. Their recommendation is to the following effect: "That a clause or clauses be inserted in the Bill to provide that the London County Council (Subways) Act, 1893, shall be so extended as to apply to any subway or subways which may be constructed by the Council in connection with the foregoing improvements, and also a clause or clauses to provide that in all cases where, in connection with the foregoing improvements, pipes have to be altered in consequence of the construction of the subway or the widening of the thoroughfare, the Council shall have power to require the companies to move into the subway the pipes already existing in any of the said thoroughfares." The proposals have been submitted to the Finance Committee, and a report thereon will probably be presented to the Council to-day.

Billing's Burner Syndicate in Liquidation.—A compulsory winding-up order having been made against the above-named Company, the usual meetings of creditors and shareholders were held last Tuesday, at the Board of Trade Offices, Carey Street, W.C.—Mr. A. S. Cully, Assistant Official Receiver, presiding. It appeared from the Official Receiver's report that the Company was incorporated on May 4, 1898, with a nominal capital of £8000 in 800 shares of £10 each, to acquire and work the inventions of Mr. C. E. Billing relating to improvements in the construction of gas-burners; also the art metal business carried on by him and his family in Great Titchfield Street, W. The total capital issued amounted to £3830, of which £1830 represented cash subscriptions, and £2000 was issued as fully-paid shares in respect of the patent rights. Apart from the sale of the burners, the Company appeared to have done very little business. The failure of the Company was attributed by the officials to want of capital to so advertise the burner as to bring it prominently before the public, and to the heavy expenses incurred in carrying on the business. A statement of affairs had been filed, disclosing liabilities £4377, and net assets £102; the deficiency as regarded both creditors and shareholders being returned at £8025. It was decided to leave the matter in the hands of the Official Receiver as Liquidator of the Company.

The "Eureka."

Wright's "Eureka" Gas-Cookers.

By closing the hinged top, the loose Burners are automatically fixed.

All parts underneath can be easily cleaned.

These Improvements do not increase the cost of the Cooker.

OVER 6000 IN STOCK.

ALL ORDERS EXECUTED IMMEDIATELY.

◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆

JOHN WRIGHT & CO.,
(Now John Wright & Eagle Range, Ltd.)

BIRMINGHAM, LONDON, MANCHESTER, LIVERPOOL, and BRISTOL.

Queenstown Water Supply.—The Local Government Board for Ireland have sanctioned a loan of £10,000 for the completion of the Queenstown Urban District Council's water-works and their extension to Government Buildings on Haulbowline Island. The loan, which is granted in pursuance of section 237 of the Public Health (Ireland) Act, 1878, and repayment of which is to be spread over a period of 50 years, is to be issued in four instalments of £5000, £3000, £1500, and £500.

Suggested Purchase of the Abercarn Gas-Works by the District Council.—A week since, at the meeting of the Abercarn District Council, the Electrical Committee recommended that, before proceeding further in the matter of the supply of electricity in the district, the Council should endeavour to ascertain whether the Newbridge and Abercarn Gas Company were prepared to enter into negotiations for the sale of their works. The Chairman stated that the Risca District Council proposed taking a similar step with regard to the Risca Gas Company; and if these negotiations fell through, probably the two Councils might then consider a joint scheme of electric lighting. The recommendation of the Committee was adopted; and a deputation was appointed to meet the Gas Company.

New Gasholder at Maidstone.—On Thursday, the 13th inst., Mr. W. Bryant, the Deputy-Chairman of the Maidstone Gas Company, in the unavoidable absence of Mr. George Marsham, the Chairman, performed the ceremony of turning on the gas to the large new holder which has been in course of construction during the past fifteen months, and thence to the town mains. After opening the valves of the holder, Mr. Bryant, in a few appropriate words, remarked how expeditiously and well the work had been carried out by the respective Contractors, and said he considered that it was highly creditable to all concerned. Among those who witnessed the ceremony were several Directors, Mr. R. Hoar (Clerk), Mr. Henry Smythe (Engineer and Manager), and Mr. H. K. Kindler (Assistant-Engineer). Mr. Pickering, of Leeds, and Mr. S. While, of London, were also present, representing Messrs. Clayton, Son, and Co., Limited, of Leeds, the Contractors for the holder. Messrs. John Aird and Sons were the Contractors for the tank.

Derwent Valley Water Board.—At the invitation of Alderman R. T. Gainsford, of Sheffield, Chairman of the Derwent Valley Water Board, a large and distinguished company were entertained to dinner at the Hotel Cecil, on Monday, the 10th inst., tomark the commencement of the works of the Board. The gathering was composed of the representatives of the constituent bodies who will be supplied with water by the Board, and the dinner was held in London in order to permit of the local members of Parliament and Counsel engaged in the Bill being present. The Duke of Devonshire proposed "Success to the work of the Derwent Valley Water Board," to which the Chairman responded. He explained the scope of the undertaking, and paid a high tribute to Sir John Brunner for what he had done in connection with the Bill. He ventured to regard the success of the Derwent Board—a success he would say already assured by the devotion and impartiality of every member upon it—as no small step in the progress of the local government of the country.

Wigton District Council and the Gas-Works.—The members of the Wigton District Council are considering a proposal to purchase the property of the Wigton Gas Company, Limited. The question has not yet been definitely decided, but the Company are willing to sell at a price to be fixed by arbitration. The works were established in 1831—the original capital being £4000; but 24 years later they were enlarged, and the capital was increased to £5160. About 1000 tons of coal are carbonized annually. The price of gas is 3s. 9d. per 1000 cubic feet.

Northam Water-Works.—It was decided by the Northam District Council at a recent meeting to apply to the Local Government Board for power to borrow £12,000 for the completion of the water-works. The loan already raised for the purpose amounts to £27,000; but the original contract was for £26,000, and the Council afterwards granted the contractors £1000 additional because of the great advance in the price of iron. A statement submitted to the Council by Mr. Baldwin Latham, the Engineer of the scheme, showed that extra work to the amount of £5027 had been executed, and that the estimated cost of extras remaining to be done was £532. Superintendence was put down at £1104; engineer's commission, £1700; contingencies, £335; survey and Parliamentary Bill, £562; legal charges, £227. Other items, including the cost of the site of the reservoir, brought the total estimated cost up to nearly £39,000. Mr. Gerrard, a member of the Council, stated that about one-tenth of the work remained to be done at the reservoir, and 17½ miles out of 22 miles of mains had to be laid. The contractors applied for an extension of six months in the time given for the completion of the work. It was decided to confer with Mr. Latham before granting this request.

Suffocations by Gas.—Dr. Green, Deputy-Coroner for the district of North-East Derbyshire, recently held an inquest at Clowne, touching the death of a girl named Hannah Jane Edwards, aged 11, who was suffocated by gas. The deceased and her sister lived with their brother, a miner, and the girls slept together. They went to bed one night as usual, and left the gas burning low. On the following morning, their sister-in-law entered the room about six o'clock, and was almost overcome by the smell of gas—the bracket tap being turned full on. The window was closed, and there was no fireplace in the room. Both girls were unconscious, and were taken downstairs, where the deceased expired in a few minutes, and her sister was only restored by the persistent efforts of the medical man called in. The Jury returned a verdict of "Accidental death." An old lady named Alice Saxton, widow, of Ashton-on-Mersey, was found dead on the floor of her room a few days since. The gas had been escaping from one of the jets of the chandelier. The police thought deceased had met her death by suffocation, in consequence of falling out of bed when in the act of turning the gas on or off. A girl named Ruth Black, engaged in domestic service at Preston, was found in bed unconscious on last Thursday morning, with a novel by her side and a strong smell of gas in the room. It is supposed that after reading in bed she turned out the light; but in withdrawing her hand accidentally knocked the tap back—thus permitting the gas to escape. Strenuous efforts were made to resuscitate her; but she died on Friday.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

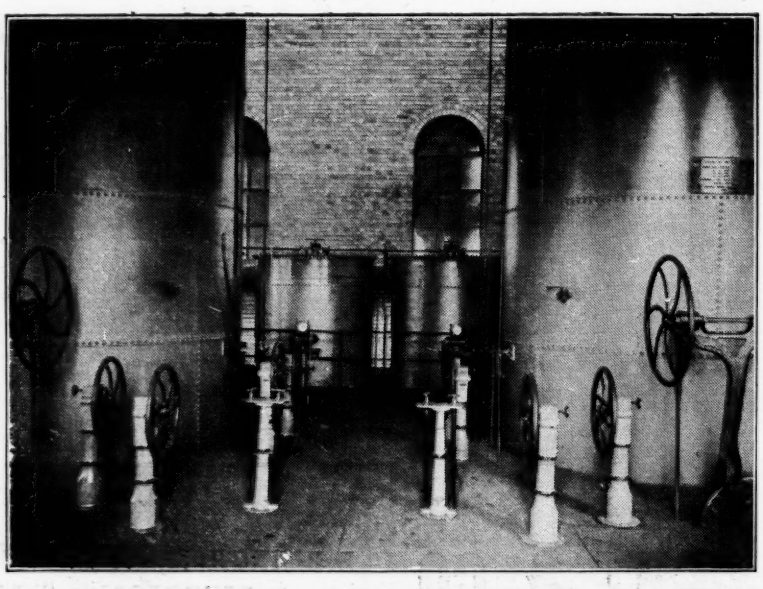
The Economical Gas Apparatus Construction Co., Ld.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

CARBURETTED WATER-GAS ENGINEERS.

THE M.-W.-P. PLANT is designed to use the Heaviest as well as the Lightest Grade of Oil.



RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

New Joint-Stock Companies.—The Inverted Incandescent Lamp Syndicate, Limited, has been registered with a capital of £12,500, in £1 shares, to adopt two agreements with Mr. J. Bridger (vendor) and one with the Sunlight and Safety Company, Limited, and to carry on the business of lamp, burner, and fittings manufacturers, makers of appliances for increasing illuminating power, gas manufacturers, electricians, suppliers of gas and electricity, manufacturers of electrical accessories, &c. The British Incandescent Light Company, Limited, with a capital of £1000, in £1 shares, will carry on the business of makers and importers of, and agents for, incandescent mantles, burners, fittings, and all accessories connected with incandescent lighting.

Swansea Reservoir Contract.—At a recent special meeting of the Swansea County Council, the Mayor (Mr. W. Watkins) moved a resolution giving to Messrs. John Paterson and Son, Limited, the Contractors for the new reservoir, formal notice of their failure to perform their obligations, as reported by the Engineers, and also notice that on and from the 18th inst. the Corporation would determine the contract, and take the works comprised therein wholly out of the Contractors' hands, together with possession of the plant upon the works, and complete the contract, or such part thereof as they should determine, at the expense of the Contractors. The Corporation also gave notice that they would proceed to deduct or recover the additional cost of carrying out the works from the Contractors as liquidated damages. The motion was carried.

Carlisle Gas Committee and their Workmen.—At the meeting of the Carlisle Corporation last Tuesday week, the minutes presented by the Gas Committee contained the correspondence between Mr. Lynas, the local Secretary to the Gas Workers' Union, and Mr. C. B. Newton, the Gas and Water Engineer to the Corporation, in reference to demands made by the Executive Committee of the Union, acting for the Carlisle Branch, for better wages and conditions of labour for the gas-works employees. The terms of the arrangement come to between the parties were given in the "JOURNAL" for the 11th inst. The adoption of the minutes having been moved, Mr. Collin suggested that the pay of the labourers should be 5d. per hour, instead of a fraction over 4½d. as at present. The voting on this proposition being equal, the Mayor (Mr. J. Hurst) gave his casting vote in its favour, and the minutes were confirmed.

Tonbridge Water Company.—The annual meeting of this Company was recently held at the Central Hall, Tonbridge, when Mr. J. Fagg presided. The Directors recommended a dividend for the half year ended the 31st of March last of 3s. per share on 2974 shares, and one of 2s. 1d. on the 2800 additional shares—making 7s. 6d. per share for the year on the ordinary shares, and 5s. 3d. on the additional shares—and that the balance of £34 8s. should be carried forward. The Board of Trade had authorized the Company to increase their capital from £24,869 to £47,869, with borrowing powers to the extent of one-fourth. The purchase of the racecourse meadows, to protect the gathering-grounds of the Company, had been completed. The engines at the works had been repaired, and all the plant was in excellent working order. There was a steady increase in revenue, and the water still maintained its excellent quality. The report was adopted.

Coventry Water-Works Profits.—The net profits of the Coventry Corporation Water-Works for the year ending March 31 last amount to £4612. Including the balance brought forward from the last account, the Committee have in hand £5349; and of this they recommend that £3000 be paid to the borough fund—being the same amount as last year.

Acetylene Lighting of French Towns.—According to "Le Journal de l'Acétylène," there are 25 towns in France in which acetylene gas is employed for public and private illumination; the latest places to adopt the system being Arnay-le-Duc and Senonches. The latter works comprises a dwelling-house for the Manager, a room for the plant, and nearly 4 miles of pipes. The number of consumers obtained since the start has been 80. Each apparatus furnishes 88·2 cubic feet of gas per hour to supply 250 burners. If each of the generators is charged with 220½ lbs. of carbide, 1060 cubic feet of gas are obtained, sufficient for 30 hours' lighting. At Arnay-le-Duc, the works have 4 generators, on the automatic "carbide to water" system. The initial charge is 374 lbs., which quantity can be increased *ad infinitum*. There are 85,560 yards of pipes, either cast iron or lead, 70 public lamps, and 165 consumers. The cubic metre (35·3 cubic feet) of acetylene equals 20 cubic metres (706 cubic feet) of coal gas, and is sold by meter. The street-lamps resemble the electric arc lamp with a large shade of enamelled iron and globe 13 inches in diameter.

Carlisle New Water Scheme.—At the last monthly meeting of the Carlisle Town Council, some reference was made to the Geltsdale water scheme, by which it is intended to provide the city with water by gravitation in lieu of the present supply, which is obtained from the River Eden. As previously mentioned in the "JOURNAL," the lowest tender sent in is £25,000 over the Engineer's original estimate, while the highest is £53,000 above it. Mr. E. M. Eaton, of Westminster, the Consulting Engineer, had been requested to attend a meeting of the Gas and Water Committee to discuss the tenders; but he had not been able to be present. The Committee had thereupon passed a resolution to adjourn the matter. Mr. J. J. Forster said the scheme began badly, and it was doubtful whether it would have been adopted if they had been told it would cost £200,000—the figure which they might now expect to reach. He moved that nothing more be done in regard to the scheme for twelve months, and that in the meantime an independent engineer be called in, with the understanding that if his report was not satisfactory the scheme should be dropped altogether. After further discussion, it was agreed to leave the matter over to give the Committee an opportunity of having an interview with the Consulting Engineer, and coming to some decision. The estimate of the Engineer (Mr. C. B. Newton) for the whole of the scheme was £129,000, and that of the Consulting Engineer, £150,000. Mr. Eaton met the Committee last Tuesday, when the first thing done was to clear up a certain amount of mystery surrounding his non-attendance. Passing to the excess of the tenders over the Engineer's estimates in regard to No. 1 contract, Mr. Eaton said he could reduce the cost of the works by £8000 or £9000 without impairing their efficiency. The Committee thereupon instructed him to report fully upon the subject.

C. & W. WALKER, Ltd.

Midland Iron-Works,

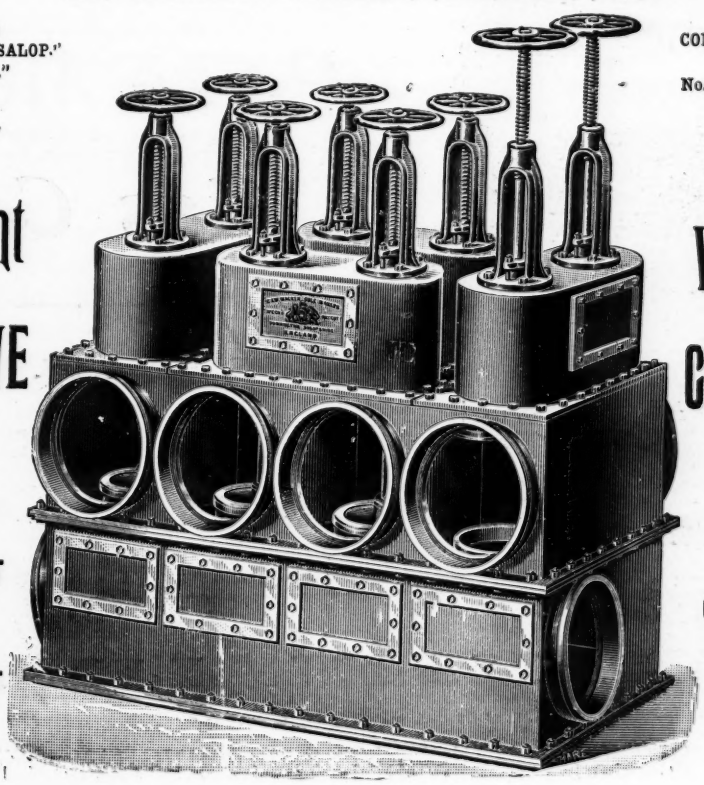
DONNINGTON, Near NEWPORT, SHROPSHIRE.

110, CANNON STREET, LONDON, E.C.

Telegraphic Addresses:
"FORTRESS, DONNINGTON, SALOP."
"FORTRESS, LONDON."

CODES USED: A.B.C. AND A.1.
Telephone:
No. 12 WELLINGTON, SALOP.

Weck's Patent
CENTRE-VALVE



Weck's Patent
CENTRE-VALVE

PERFECTLY TIGHT UNDER EVERY EXTREME OF HEAT OR COLD.

THE ONLY ABSOLUTELY RELIABLE CENTRE-VALVE IN THE MARKET.

Littlehampton Water Supply.—The new water supply for Littlehampton was inaugurated on Monday last week. The works at Warningcamp will not be completed for some months, but sufficient progress has been made to enable the water to be pumped into the town by means of the temporary machinery; and it was shortly before noon on the above-named day that the town was given its new permanent supply without ceremony of any kind.

Public Lighting at Launceston.—At their meeting yesterday week, the Launceston Town Council had under consideration a report by the Town Clerk respecting an interview which the Mayor, the Surveyor, and he had had with the Chairman and the Manager of the Gas Company, respecting the tender for public lighting. The result was that an amended tender was submitted. Mr. Powell, a member of the Council, said a very long conflict between them and the Company had ended honourably. Mr. Treleaven, Manager of the Company, said the Directors were always willing and anxious to act fairly towards the Council. Taking everything into consideration, there was very little difference in the price to be paid in future and that paid in the past. The Company lost money by the lighting and extinguishing of the lamps, and would rather this were done by the Council. The Directors did not think it desirable that the public lamps should be supplied at a ridiculously low figure, as was done in some towns, and the private consumers made to pay a high price in consequence. Mr. Downing said that under the new contract the price to be charged was 12s. 6d. per lamp, less six lamps in the inner circle, 9s. 10d. for lamps in the centre circle, and 5s. for those in the outer circle.

The Caterham Gas Company have placed an order with Messrs. R. Dempster and Sons for new carbonizing plant on the Chester regenerator system.

The Carron Company, who have a large display of cooking apparatus and other goods in the Heating and Lighting Section of the Glasgow Exhibition, have in hand two orders for cooking apparatus to be erected at Windsor Castle.

The widow of a workman named Edward Andrew, whose death occurred at the Ashton-under-Lyne Gas-Works, in July last year, while in the execution of his duty, has been awarded by His Honour Judge Brown, at the Ashton County Court, £171 12s., being three years' wages at 22s. per week. The sum is to be appropriated as follows: £20 and 10s. per week to the widow, and 4s. per week for each of her three children.

At the meeting of Sleaford Rural District Council last week, Mr. Clare reported that the boring in connection with the new water-works at Leasingham had resulted in a splendid spring of water being tapped at a depth of 110 feet. It yielded 42,000 gallons per day. It was resolved that application be made to the Local Government Board for a further loan to cover the cost of the distribution of the water through the parish.

Messrs. Jonas Drake and Son have secured an order from the Stockton Corporation for elevators and conveyors in connection with their purifying-house.

The issue by the Weymouth Consumers' Gas Company of £10,000 of 3½ per cent. perpetual debenture stock, which was recently advertised in our columns, has been over-subscribed for at prices ranging from the minimum of £98 to par; the average price obtained being £98 6s. 1d. per cent.

The Gandy Belt Manufacturing Company, Limited, have obtained a perpetual injunction, with costs, against Messrs. Fleming, Birkby, and Goodall, Limited, restraining them from using the name "Gandy" in connection with machine belting not of the Company's manufacture, selling such belting, and infringing their trade marks. Messrs. Fleming and Co. are to pay over the profits made by the sale of the merchandise in question.

Messrs. Jordan and Sons, Limited, have published a new volume by Mr. Henry Warren (author of "How to Deal with your Banker"), entitled "Your Bankers' Position at a Glance." The balance-sheet of every bank of any importance in the United Kingdom has been carefully analyzed, and so arranged that the reader can see his bankers' position literally "at a glance." We believe this is the first book dealing with the whole of the banks in the United Kingdom that has been placed before the public.

Messrs. J. Firth Blakeley and Co. have recently received from the Portland District Council orders for a set of their new patent rectangular condensers and extractors, with all valves, &c.; also from the same Council orders for four 12-feet square purifiers, combined steam-engine and gas-exhauster, governor, &c. The firm have in hand for the Wollaston Gas Company a 50-feet by 20-feet gasholder, exhauster, gas-engine, governor, hydraulic mains, &c.; and they have recently supplied the Company with a tower scrubber and two 8-feet square purifiers. Among other work in progress is a gasholder, 40 feet in diameter, and cast-iron tank for the Boroughbridge Gas Company, including all excavations, &c.

The advantages resulting from the organization of a fire brigade on large works were recently manifested in the case of the Stratford branch of the Richmond Gas Stove and Meter Company, Limited. On the morning of the 14th inst., a fire broke out in the boiler-house of Messrs. Conrad Schmidt and Co., varnish manufacturers, whose premises are adjacent to those of the Richmond Company. The works fire brigade of the latter were immediately on the scene, and played upon the burning building from the roof of their fitting-shop, effectually preventing it from spreading. Considerable damage was done to the varnish works, but none to the Richmond Company's premises. In the course of the day, a letter was received from Mr. Schmidt, conveying his thanks to the employees for their great promptness and zeal in rendering assistance in extinguishing the fire, and assuring them of his high appreciation of their kindness. In testimony of the sincerity of his sentiments, he sent a present of £5 5s. for the men.

The "Main" Prize Medal Gas Cooker.

Prices, £2 10s. to £13 10s.

Strong, Durable, and Efficient.

R. & A. MAIN, LIMITED,

LONDON, GLASGOW, MANCHESTER, BIRMINGHAM, & BRISTOL.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

TERMS OF SUBSCRIPTION to the "JOURNAL."
One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in Advance. If credit is taken, the charge is 25s. a year.
Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.
ANDREW STEPHENSON, AGENT. All communications *re* Oxide to the Company as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for use in GAS-WORKS.
ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

SULPHATE OF AMMONIA
SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., Central Plumbing Works, Victoria Square, BOLTON.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.
H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

NEW GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

TO GAS AND WATER OFFICIALS.
HIGH-CLASS CYCLES at Reasonable and LOW PRICES. Guaranteed and sent on approval. For Cash or Gradual Payments. Catalogue post free. Old Machines Exchanged or Repaired.
MELROSE CYCLE COMPANY, COVENTRY.

PRACTICAL RETORT SETTERS.
GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent-Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO THE CHAIRMEN AND DIRECTORS OF GAS COMPANIES,
WHOSE ASSESSMENTS HAVE BEEN UNJUSTLY INCREASED, OR ARE ALREADY TOO HIGH.
AN experienced and successful Rating SURVEYOR will be happy to render assistance to Companies in these positions.
Address No. 3707, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MANAGER and Foreman (Gas-Fitting, &c.), seeks re-engagement. Well up in Autos. Large Experience. Age 36 Years. Total Abstainer.
H. WRIGHT, 102, Harvist Road, KENSAL RISE.

WANTED, Retort Setters.
Apply, by letter, to No. 3708, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted. One accustomed to Elevating and Conveying Machinery.
Apply to JONAS DRAKE AND SON, Ovenden, HALIFAX.

TRAVELLER (GAS-STOVE TRADE).
WANTED for the Provinces. Must have good experience and influence.
Apply, by letter, with all Particulars to No. 3709, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for Permanency, a Steady Young Married Man, Cyclist, Active, to reside at Service Reservoir in Company's house, and act as TURNCOCK, PLUMBER, and SERVICE LAYER.
Apply, stating Age, Wage, and Experience, to the MANAGER, Water-Works, Mistley, ESSEX.

WANTED, One or Two thoroughly reliable and steady Men as STOKERS. Must be good Shovel Chargers, and used to Engine and Exhauster.
For further Particulars apply to H. C. SHEPHERD, Manager and Secretary, Gas-Works, SWINDON.

MECHANIC and Blacksmith wanted, willing to make himself generally useful on the Works. Applicants must have had experience in an Engineer's Workshop.
State previous Employment, Age, Wages required, and enclosing *copies* of Testimonials, to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

CLEETHORPES GAS COMPANY.
WANTED, an energetic and reliable Young Man as METERS and STOVES INSPECTOR and ASSISTANT in the DISTRIBUTING DEPARTMENT. Must have some practical knowledge of Gas-Fitting. Commencing Wages, 24s. per week.
Applications to be sent to E. J. BROCKWAY, Engineer and Secretary.

WANTED, a Gas-Works on Lease or Purchase, by thoroughly practical Gas Engineer.
Address No. 3665, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE LET on Lease. Possession the 25th of March, 1902. The Hedinghams (Essex) Gas-Works as a going concern, with Manager's Cottage.
Apply to the SECRETARY, Castle Hedingham, ESSEX.

FOR SALE, Cheap—Two Purifiers, 8 ft. square by 4 ft. deep, in good condition, with Valves, Connections, and Lifting Gear.
INQUIRIES for all kinds of SECOND-HAND GAS PLANT will also be esteemed by SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

FOR SALE—Cheap to Clear.
One GASHOLDER, 50 ft. by 16 ft., 12 Years old.
One " 25 ft. by 10 ft., 6 "
One " 15 ft. by 10 ft., 6 "
Erected complete. New Steel Tanks supplied.
Six Annular CONDENSERS, 30 feet high. Perfect.
Two PURIFIERS, 22 ft. by 8 ft., complete and good.
Four " each 10 ft. and 6 ft. square.
Two " each 8 ft. and 6 ft. square.
Other Plant and Sizes in Stock. Photometers, Gauges, &c.
Apply J. FIRTH BLAKELEY & Co., Thornhill, DEWSBURY.

OXIDE OF IRON OF FINEST QUALITY.
BALE'S Special Fire Cement should be used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.
Send for full Particulars to
BALE & Co., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

TO BE SOLD—
SINGLE GASHOLDER, 22 ft. by 10 ft. Four Columns
One PHOTOMETER by Sugg & Co., with 10-Candle Pentane Apparatus.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

FOR SALE—One Second-hand Gasholder in good condition, 40 ft. diameter by 14 ft. deep, with Five Cast-Iron Columns and Lattice Girders. This can be offered either erected in Brick Tank to be built to my Drawings, or supplied complete with Steel Tank and fixed ready for work.
For Price and Particulars, apply to
JOHN ANDREWS.
Gas-Works, Langley Mill.

ABERTILLERY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)
OFFERS are required for Two Second-Hand PURIFIERS with Lids, and two Four-Way Valves complete.
Purifiers are 6 feet square, and 4 feet in depth. Two of the Plates have been chipped at the angles in removal.
JAS. M'BEAN,
Manager.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

YEADON AND GUISELEY GAS COMPANY.
FOR SALE—One Second-hand Purifier, 14 ft. square, 4 ft. 6 in. deep, with Four-way Valve, 12-inch diameter Connections, Two Floors, Wood Grids, and Travelling Lift by Cockey and Sons. The whole in really good condition. Can be seen at the Gas-Works, Yeadon, near Leeds.
Offers may be made to the undersigned, at his Office in Yeadon.
By order,
EDWARD LISTER,
Secretary and Manager.
Gas Offices, Yeadon,
June 18, 1901.

SECOND-HAND Station Meters for SALE—
ONE RECTANGULAR STATION METER, 10,000 cubic feet per hour, 10-inch Connections, Two Valves and Water Lute, Clock and Tell-tale, with New Drum.
TWO ROUND STATION METERS, 8000 cubic feet per hour, 9-inch Connections, Two Valves and Water Lute, with New Drums.
ONE ROUND STATION METER, 4000 cubic feet per hour, 7-inch Connections, Two Valves and Water Lute, with New Drum.
ONE ROUND STATION METER, 4000 cubic feet per hour, 6-inch Connections, Three Screw-Down Valves.
TWO ROUND STATION METERS, 3600 cubic feet per hour, 6-inch Connections, Three Valves, one with Cradle, one with New Drum.
ONE ROUND STATION METER, 2400 cubic feet per hour, 4-inch Connections, Four-Way Cock By-e-Pass and Cradle, with New Drum.
Prices and further Particulars on application to JAMES MILNE & SON, LIMITED, Milton House Works, EDINBURGH; or Midland Meter Works, 48, Wellington Street, LEEDS.

SHIFNAL GASLIGHT AND COKE COMPANY.
THE above Company are prepared to receive TENDERS for the supply of good GAS COAL, NUTS, or BEANS including Carriage to the G.W. Rly. Station, Shifnal, for One Year from or soon after the end of the present Month.
Evidence as to quantity of Coal must accompany each Tender.
Quantity required, about 800 Tons per annum in proportionate deliveries as directed—say 60 per cent. during Winter months, and 30 per cent. during Summer Months.
Sealed and marked Tenders must be sent to the undersigned not later than the 1st day of July next.
The Company reserve to themselves the right to divide the quantity into Two or more Contracts, and do not bind themselves to accept the lowest or any Tender.
By order,
FARMER AND FARMER,
Joint Clerks.
Shifnal, June, 1901.

TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Urban District Council invite TENDERS for supplying 750 to 1000 Tons of GAS COAL; the deliveries to be made at the Shut End Siding, at such times, and in such quantities, as may be directed.

It is desirable that an Analysis of the Coal proposed to be supplied be sent with the Tender.

Sealed Tenders, marked "Coal," must reach me on or before the 2nd of July, 1901.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
JOSEPH SMITH,
Clerk to the Council.

Offices: High Ho born,
Sedgley, June 11, 1901.

THE Directors of the Keswick Gas Company invite TENDERS for their surplus TAR and AMMONIACAL LIQUOR for Twelve Months from the 30th inst., at per ton delivered into Contractor's Tanks at Keswick Railway Station.

Sealed Tenders, endorsed "Tenders for Tar," or "Liquor," will be received by the undersigned on or before Wednesday, the 26th inst., but the Directors do not bind themselves to accept the highest or any Tender.

J. H. BRODIE,
Secretary.

Keswick, Cumberland,
June 12, 1901.

THE Directors of the Keswick Gas Company invite TENDERS for the supply of 1500 Tons of best screened GAS COAL or NUTS, to be delivered to Keswick Railway Station, at such times, between the 30th inst. and the 31st of March next, and in such quantities as the Manager of the Gas-Works shall direct.

Tenders, endorsed "Tender for Coal," to be sent to the undersigned not later than the 26th inst.

The Directors do not bind themselves to accept the lowest or any Tender.

J. H. BRODIE,
Secretary.

Keswick, Cumberland,
June 12, 1901.

ILKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the supply of RETORTS and FIRE-BRICKS, particulars of which may be had by application at the Offices, Leeds Road, Ilkley.

Tenders, addressed to the Chairman, and endorsed "Tender for Retorts," must be delivered not later than Thursday, the 27th day of June, 1901.

The lowest or any Tender not necessarily accepted.

WM. EVERITT,
Manager.

ILKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the supply of 8000 Tons of best screened GAS COAL, to be delivered at Ilkley Station, during the next Twelve Months ending July 31, 1902, in such quantities monthly as may be required.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Coal," must be delivered not later than Thursday, the 27th day of June, 1901.

The lowest or any Tender not necessarily accepted.

By order,
WM. EVERITT,
Manager.

N.B.—Tender Forms on application at the Gas Offices, Leeds Road, Ilkley.

TENDERS FOR GAS COAL.

THE Directors of the Clayton, Allerton, and Thornton Gas Company invite TENDERS for the supply of 8000 Tons of GAS COAL, screened and unscreened, and 1000 Tons of CANNEL COAL. The Coal to be free from Scale, Sulphurous Pyrites, or other objectionable matter, and to be delivered at the Gas-Works, Low Lane, Clayton, or at the Great Northern Railway Station, Clayton, in such quantities weekly as may be ordered by the Company's Manager, during the next Twelve Months from the 1st of July, 1901. The said Tenders to state the Seam and the Pit from which the Coal is intended to be sent.

Sealed Tenders, endorsed "Tender for Coal or Cannel," addressed to the Chairman, at the Gas-Works, to be delivered at or before Noon on Monday, the 8th day of July, 1901.

The Directors do not pledge themselves to accept the lowest or any Tender; reserving to themselves the right to divide the Contracts as they may think proper.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas Office, Clayton,
Near Bradford, June 18, 1901.

TENDERS FOR TAR.

THE Directors of the Clayton, Allerton, and Thornton Gas Company invite TENDERS for the purchase of the COAL TAR produced at these Works during a period of Twelve Months from the 1st day of July, 1901, to the 30th of June, 1902.

Quantity, about 400 Tons.

The Tar will have to be removed daily from the 1st of October to the end of April.

Sealed Tenders, endorsed "Tender for Tar," addressed to the Chairman, at the Gas-Works, and to be delivered at or before Noon on Monday, the 8th day of July, 1901.

The Directors do not pledge themselves to accept the highest or any Tender.

By order,
JOHN NIVEN,
Secretary and Manager.

Gas Office, Clayton,
Near Bradford, June 18, 1901.

THE Derby District Residual Product Committee invite OFFERS for their surplus TAR and LIQUOR.

Approximate quantities: Tar, 1000 Tons; Liquor, 1500 Tons.

For Form of Tender and Particulars, apply to J. ANDREWS, Gas-Works, LANGLEY MILL.

THE Portishead Gas Company, Limited, invite TENDERS for supplying 800 Tons of GAS COAL, to be delivered at the Portishead Dock (by Water) or at their Siding (by Rail), at such times and in such quantities as may be required by the Manager.

An Analysis of the Coal must be enclosed with the Tender.

Sealed Tenders, endorsed "Tenders for Gas Coal," and addressed to the Chairman of the Company, must reach me not later than July 6.

The Company do not bind themselves to accept the lowest or any Tender.

A. W. STONE,
Manager.

Gas-Works, Portishead, Somerset,
June 22, 1901.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

THE above Board are prepared to receive TENDERS for 6000 Tons of GAS COAL and 1000 Tons of CANNEL, to be delivered free into the Gas Board's Sidings at Hebden Bridge, in quantities as required during the next Twelve Months.

Forms of Tender and further Particulars may be had on application to R. West, Manager.

Tenders, endorsed, and addressed to E. J. Crossley, Esq., Chairman, must be delivered by Thursday, June 27, 1901.

The Committee do not bind themselves to accept the lowest or any Tender; and reserve to themselves the right to divide the quantity as required.

By order of the Board,
R. CRABTREE,
Clerk.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and delivery of about 11,000 Tons of GAS COAL.

Form of Tender, &c., may be had on application to the undersigned at the Gas-Works.

Tenders, endorsed "Gas Coal," to be addressed to the Chairman of the Gas Committee, and sent to me at the Gas-Works, before Twelve o'clock on Tuesday, the 16th day of July, 1901.

The lowest or any Tender not necessarily accepted.

By order,
WM. NORTH,
Engineer and Manager.

Stourbridge Gas-Works,
June 24, 1901.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the purchase of their surplus TAR for the Year ending June 30, 1902.

Tenders, endorsed "Tar," to be addressed to the Chairman of the Gas Committee, and sent to me at the Gas-Works, on or before Tuesday, July 16, 1901.

The highest or any Tender not necessarily accepted.

By order,
WM. NORTH,
Engineer and Manager.

Stourbridge Gas-Works,
June 24, 1901.

SOUTH SHIELDS GAS COMPANY.
TO COALOWNERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of 47,000 Tons of clean, unscreened GAS COAL, for delivery into Craft and at the Company's Depôt, South Shields, as required, from July 20, 1901, to May 31, 1902.

The Directors reserve to themselves the right of taking the Coal in one or more lots.

The lowest or any Tender not necessarily accepted.

Particulars as to deliveries, &c., may be obtained at the Gas-Works, on application to Mr. T. H. Duxbury, the Engineer.

Sealed Tenders, to be delivered to the undersigned not later than the morning of Tuesday, the 2nd prox., endorsed "Tender for Coal."

J. H. PENNEY,
Secretary.

Gas Offices, Chapter Row,
South Shields, June 20, 1901.

ALTRINCHAM GAS COMPANY.
COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL and CANNEL for One Year from the 1st of August, 1901. Estimated quantities required: Coal 10,000 Tons, Cannel 4500 Tons.

Deliveries to be free at Altrincham Railway Station and as required.

Sealed Tenders, endorsed "Tender for Coal or Cannel," stating the description of each, the Pits from which they are to be raised, the quantity proposed to be supplied, and the Cash Terms for monthly payments, to be sent addressed to the undersigned, so as to be received not later than Twelve o'clock noon on Saturday, the 6th day of July next.

The Directors do not bind themselves to accept the lowest or any Tender; but the person or persons whose Tender may be accepted will be required to execute an Agreement for the due performance thereof.

No special Form of Tender is required or supplied.

F. R. B. LINDSELL,
Secretary.

Gas Offices, Moss Lane,
Altrincham, June 20, 1901.

NORTHWICH GAS COMPANY.

THE Directors of the Northwich Gas Company invite TENDERS for the supply and delivery at Northwich Station of about 5000 Tons of GAS COAL during the Year ending June 30, 1902.

Any further Particulars can be had on application to Mr. S. S. Mellor, the Manager.

The lowest or any Tender not necessarily accepted.

Tenders, addressed to the Chairman, must be delivered here not later than July 5.

HENRY PICKERING,
Secretary.

Northwich, June 22, 1901.

ROTHERHAM CORPORATION.
COAL CONTRACTS.

THE Gas Committee invite Tenders for the supply and delivery at the Gas-Works, Frederick Street, Rotherham, from the 1st of October next, of 16,000 Tons of best screened GAS COAL.

Form of Tender may be obtained upon application to the Secretary at the Gas-Works.

Sealed Tenders to be sent to me not later than the 6th of July next, endorsed "Tender for Coal."

By order,
H. HAMPTON COPNALL,
Town Clerk.

Council Hall, Rotherham,
June 21, 1901.

GUILDFORD GASLIGHT AND COKE COMPANY.
TO TAR DISTILLERS.

THE Directors of the above Company are prepared to receive TENDERS for the surplus COAL GAS TAR and CARBURETTED WATER-GAS TAR, separately or mixed, produced by the above Company, for the Year ending the 30th of June, 1902. Coal carbonized, about 12,000 Tons per annum.

All Tenders to state the price per cask of 40 gallons.

Cartage to and from Railway Station, Guildford, free. All empties to be provided by Contractor.

Tenders, endorsed "Tar," to be sent to David Williamson, Esq., J.P., C.C., Chairman of the Gas Company, Guildford, on or before July 4, 1901.

By order,
WILLIAM TITLEY,
Secretary.

Gas Offices, Guildford,
June 14, 1901.

SWINDON GAS AND COKE COMPANY, LIMITED.
TENDERS FOR GAS COAL.

THE Directors of the above Company are open to receive TENDERS for from 500 to 3000 Tons of best Screened GAS COAL, delivered free to the Great Western Railway Station or the Midland and South-Western Junction Railway Station, Swindon, in such quantities and at such times as may be directed during the ensuing Twelve Months.

Tenders (endorsed) must state for which Station the price is quoted, and be delivered not later than Saturday, the 29th inst.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
H. C. SHEPHERD,
Secretary.

Gas-Works, Cricklade Road,
Swindon, June 12, 1901.

EXMOUTH GAS COMPANY.
TENDERS FOR GAS COAL.

THE Directors of the Exmouth Gas Company invite TENDERS for 3000 Tons of clean unscreened (through and through) first-class DURHAM or ANY OTHER GOOD GAS COAL, to be shipped in such quantities (by Sailing Vessels only), and at such times as may be required, commencing from the 1st of August next.

Tenders to be accompanied by practical Working Analysis, and Prices may be quoted c.i.f. or f.o.b. at Exmouth Docks.

Sealed Tenders to be sent to the undersigned, addressed to the Chairman of the Company, and endorsed "Tender for Coal," not later than Saturday, the 29th day of June.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender (no Special Form of Tender issued).

By order,
JAMES T. FOSTER,
Secretary and Manager.

Gas-Works, Exmouth,
June 4, 1901.

BOROUGH OF BEVERLEY.
TENDERS FOR COAL.

THE Gas Committee are desirous to receive TENDERS for the supply of not exceeding 6000 Tons of COAL for use at the Gas-Works, Beverley, for a period of Twelve Months from the 1st of October next, to be delivered as from time to time directed, and at the expense of the Contractors, f.o.b. at Keadby, or at the Pits, or at the Railway Station, Beverley, according to terms of Contract. The Coal to be of the best kind, well screened, free from Sulphur, Bats, Bind, Refuse, and Dirt, and to be weighed 21 cwt. to the ton upon the Corporation machine.

Payments will be made from time to time so long as the Contractor shall duly fulfil the Contract.

The Corporation do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to divide the Contract as they think fit.

Further Information may be obtained of the Gas Manager, Mr. James Gibson, at the Gas-Works, Beverley; and Tenders, endorsed "Tender for Coals," must be delivered at my Office not later than Wednesday, the 26th day of June, 1901.

J. WILLIS MILLS,
Town Clerk

THE Ruthin Gas Company invite Tenders for the supply of about 600 Tons of best screened GAS COAL, to be delivered at Ruthin Station in such quantities as may be required by the Company between the 1st day of August, 1901, and June 30, 1902.

Tenders, endorsed "Tenders for Coal," to be sent to me on or before the 5th day of July next.

DAVID JONES,
Secretary.

Ruthin, June 18, 1901.

MATLOCK AND DISTRICT GAS COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the Matlock and District Gas Company, Limited, invite TENDERS for the supply of GAS COAL (about 4200 Tons) and CANNEL (about 300 Tons) for a period of Twelve Months as from July 1, 1901.

Particulars may be obtained from the undersigned, to whom sealed Tenders, endorsed "Tender for Coal," must be delivered on or before Tuesday, the 2nd of July, 1901.

The lowest or any Tender will not necessarily be accepted.

ROBERT HALL,
Secretary.

Victoria Buildings, Matlock,
June 21, 1901.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of

1. COAL AND CANNEL.
2. LIME.
3. TUBES AND FITTINGS.
4. SULPHURIC ACID.

Specification and Form of Tender may be obtained from Mr. W. Whatmough, Gas Manager.

Contractors tendering for this work must pay their Workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.

Sealed and endorsed Tenders to be sent to me not later than Tuesday, July 16, 1901.

By order,
GEORGE G. BOUCHIER,
Town Clerk.

Municipal Buildings, Heywood,
June 19, 1901.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 8000 Tons of best GAS COAL (screened, unscreened, or large nuts), to be delivered between the 1st of August, 1901, and the 31st of July, 1902, on the Company's Sidings, Midland Railway, Rushden.

Sealed Tenders, endorsed "Tender for Coal," to be sent to the Secretary, Mr. G. S. Mason, on or before the 29th inst.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve the right to accept the whole or any portion of the quantity offered.

Further Particulars may be obtained from the undersigned.

THOMAS WATSON,
Engineer and Manager.

Gas-Works, Rushden,
June 10, 1901.

FELIXSTOWE GASLIGHT COMPANY, LIMITED.

ISSUE OF 698 5 PER CENT. CUMULATIVE PREFERENCE SHARES OF £5 EACH.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above ISSUE.

Tenders must be delivered at the Company's Office, Hamilton Road, Felixstowe, not later than Twelve o'clock at noon on Monday, the 1st day of July, 1901.

Particulars and Conditions, together with Forms of Tender, may be obtained at the said Offices, or at the Office of the Company's Solicitors, Messrs. Jennings & Haward, Felixstowe, or of the Company's Bankers, Messrs. Bacon, Cobbold, & Co., Ipswich and Felixstowe, or will be forwarded on application.

By order of the Board of Directors,
F. PATERNOSTER,
Secretary.

Hamilton Road, Felixstowe,
June 15, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ROMFORD GAS AND COKE COMPANY, LIMITED.

600 £5 FULLY-PAID "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, July 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 2nd day of July next, and WILL BE RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company to be held on the 2nd day of August next.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., June 21, 1901.

SALE OF ISSUE OF
ORDINARY NEW AND DEBENTURE STOCKS
IN THE
FAVERSHAM GAS COMPANY.

MR. C. STIDOLPH has been instructed by the Directors of the Company to SELL BY AUCTION, at the Ship Hotel, Faversham, on Wednesday, June 26, 1901, at 2.30 o'clock in the Afternoon,

£19,840
WORTH OF
ORDINARY NEW STOCK and 4 PER CENT. DEBENTURE STOCK
IN THE
FAVERSHAM GAS COMPANY,

As under:—

50 lots of Ordinary New Stock of £100 each.
100 " " " " of £50 each.
230 " " " " of £10 each.
30 lots of 4 per cent. Debenture Stock of £100 each.
75 " " " " of £50 each.

Particulars and Conditions of Sale may be obtained of the AUCTIONEER, 9, East Street, FAVERSHAM; or of Messrs. TASSELL AND SON, Solicitors, 20, West Street, FAVERSHAM.

NEWCASTLE AND GATESHEAD WATER COMPANY.

TO BE SOLD by Auction, in the Board-Room of the Company's Offices, Pilgrim Street Newcastle-on-Tyne, on Tuesday, the 16th of July, 1901, at Half-past Twelve o'clock precisely, by Mr. Charles A. Joel, in such Lots as are provided for in the Company's Act of 1894—

FIFTY THOUSAND POUNDS OF FIVE PER CENT. PREFERENCE STOCK (1894).

Printed Particulars and Conditions of Sale may be had at the Company's Offices; and Messrs. George Armstrong and Sons, Solicitors, Newcastle-on-Tyne; or of the Auctioneer, 63, New Bridge Street, Newcastle-on-Tyne.

GEORGE SMITH,
Secretary and General Manager.

Newcastle-on-Tyne,
June 11, 1901.

Net Price: Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.

GAS COMPANIES'

BOOK-KEEPING.

A Practical Treatise on the Keeping of Gas Companies' Accounts.

BY

JOHN HENRY BREARLEY & BENJAMIN TAYLOR,
OF LONGWOOD.

It is the fruit of 33 years of practical and professional experience. It is very painstaking and complete. A large portion of the matter is adaptable to the book-keeping of Local Authorities. A thoroughly practical and excellent work.—*Glasgow Herald.*

For financial intricacy, the keeping of Gas Companies' accounts is hard to equal, and the publication of "Gas Companies' Book-keeping" is timely. This treatise deals in the most exhaustive manner with the keeping of gas accounts.—*Daily Mail.*

There can be no doubt of the practical usefulness of this work to everyone concerned in the keeping of gas accounts. It is well printed on excellent paper, and neatly bound in cloth.—*Huddersfield Examiner.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

CRESSWELLS' ASBESTOS CO., LTD.
WELLINGTON MILLS
BRADFORD, YORKS.

Asbestos Spinners and Manufacturers.

Telephone No. 950. Tels.: "ASBESTOS, BRADFORD."

If you want a first-class **JOINTING** for High or Low Pressure **MANHOLES, MUDHOLES, STEAM-PIPES, STEAM-CHESTS, CYLINDERS, GAS-ENGINES, WATER, CHEMICAL, HOT AIR,** or **FIRE** Joints, faced or unfaced, state your wants to us. Ask for No. 2 Catalogue.

Applications for Colonial and Foreign Agencies desired.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

ALL PARTS FOR

GAS-METERS,

INDICES, CRANKS, WORMS, &c.

PREPAYMENT ATTACHMENTS.

Supplied by the

Tourtel Manufacturing Co., Ltd.,
146A, QUEEN VICTORIA STREET, E.C.

HYDRAULIC BLOWER

For blowing Air into Gas Purifiers for the purpose of

REVIVIFYING THE FOULED OXIDE.

Full Particulars on application.

LUXWERKE LUDWIGSHAFEN AM RHEIN.

HARDMAN & HOLDEN, LD.

ESTABLISHED 1820.

SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

Head Office: Miles Platting, MANCHESTER.

Inquiries Solicited.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 Inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad Street, E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

BOLDON GAS COALS.

Yield of Gas per Ton.	10,500 Cubic Feet
Illuminating Power	16·9 Candles.
Coke	66·7 Coke.
Sulphur	0·86 Sulphur.
Ash	2·04 Ash.

As per Analysis by
Mr. JOHN PATTINSON, F.I.C., F.C.S.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 108 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.

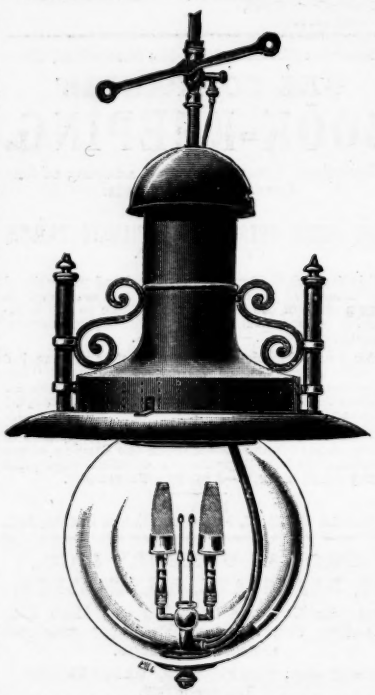
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NITRATE of Thorium and Cerium.
Farbik Chemischer Praeparate von Strahmer, Noack, and Co., Hamburg.

EVESON FOR COAL
ANOTHER REMINDER!
Telegrams: "EVESON, BIRMINGHAM."

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

THE PATENT
"BEACON" GLOBE LAMP.



Largely adopted by many Local Authorities for Public Lighting, being absolutely Shadowless and Wind-proof.
H. GREENE & SONS, Ld.,
Late of Cannon Street,
19, Farringdon Road, E.C.
Telegrams: "Luminosity, London."

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.
The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.
Apply to the Sole Makers:
THE WHESSOE FOUNDRY COMPANY, LIMITED
DARLINGTON.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE, SON, & HUNTER,
Coal Owners, Newcastle-on-Tyne;
or
E. FOSTER & CO.,
21, John Street Adelphi London W.C.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

Sixth Edition. Morocco Gilt, 21s. Roan Gilt, 18s.

HANDBOOK

FOR GAS ENGINEERS AND MANAGERS.

By THOMAS NEWBIGGING, M.Inst.C.E.

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS,

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING

GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, June 4, p. 1541.]

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

MAURICE GRAHAM.

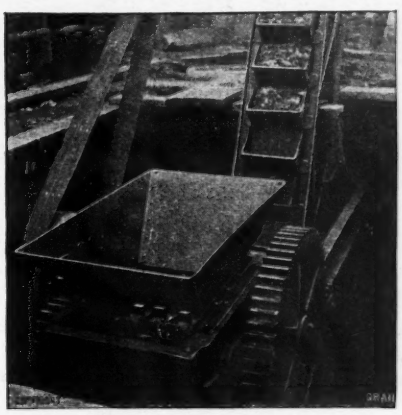
CONTRACTORS TO H.M. GOVERNMENT.

GRAHAM, MORTON & Co LTD.

WORKS:

LEEDS.

ELEVATORS & CONVEYORS.



INCLINED RETORTS.

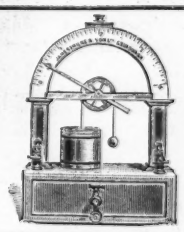
PHOTO, SHOWING ELEVATOR FOR COLD COKE.

JAMES MILNE & SON, LTD.,

GAS ENGINEERS

MILTON HOUSE WORKS EDINBURGH.

LONDON. —— LEEDS. —— GLASGOW.



MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

Telephone No. 103. Telegraphic Address: "ELEVATOR, HASLINGDEN."

S. S. STOTT & CO.,

ENGINEERS, HASLINGDEN, NR. MANCHESTER.

COAL AND COKE ELEVATORS & CONVEYORS.

COAL AND COKE STORAGE PLANTS.

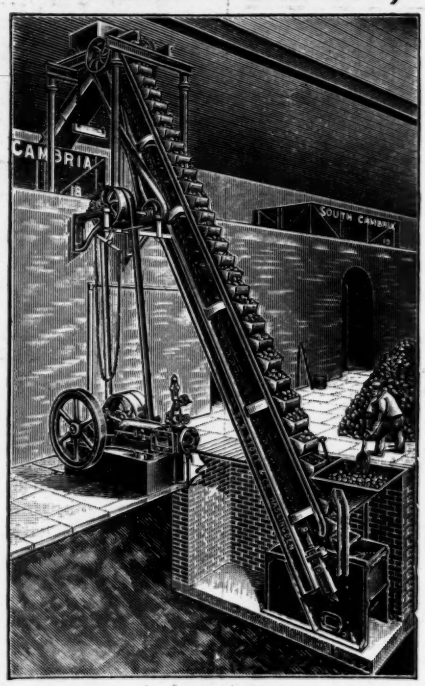
COAL AND COKE BREAKERS.

WHARF ELEVATORS FOR UNLOADING BARGES.

ELEVATORS & CONVEYORS for BOILER-HOUSES.

STAMPED AND RIVETED STEEL ELEVATOR BUCKETS.

DETACHABLE CHAINS AND SPROCKET WHEELS.



Coke Elevator Loading Railway Waggons.

LIME AND OXIDE ELEVATORS & CONVEYORS.

HIGH-CLASS STEAM-ENGINES up to 1000-Horse Power.

PUMPS, HORIZONTAL AND VERTICAL, SINGLE, DOUBLE, or THREE-THROW, for WATER-WORKS, &c.

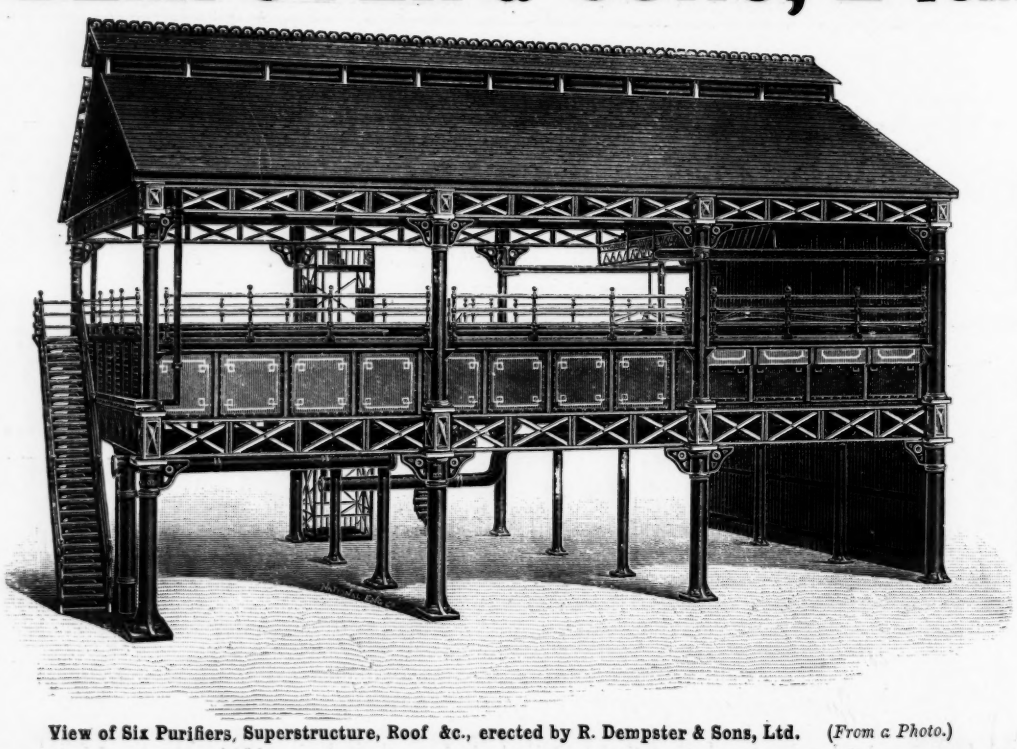
BEAM PUMPING-ENGINES.

AIR-COMPRESSORS.

BELT PULLEYS, ROPE PULLEYS, GEARING, &c., &c.

R. DEMPSTER & SONS, LD. ELLAND, YORKS.

Telegrams: "DEMPSTER, ELLAND."



Telephone: No. 8 ELLAND.

View of Six Purifiers, Superstructure, Roof &c., erected by R. Dempster & Sons, Ltd. (*From a Photo.*)

CONTRACTORS FOR EVERY DESCRIPTION OF GAS APPARATUS.

Carbonizing Plants a Speciality.

SCOTT-SNELL
SELF-INTENSIFYING LAMP.

Automatic Action.

No Complex Mechanism.

"Power" Free of Cost.

TYPE OF SCOTT-SNELL LAMPS
NOW IN USE
AT THE GLASGOW EXHIBITION.

INTENSIFIED LIGHT

WITHOUT Compressing Plant, Special Gas-Service, Water Bill, Gas-Engine or other Pumping Appliances, tearing up of Roadways, or interference with existing Service.

The **SCOTT-SNELL LAMP** may be set to give any pressure from 4 inches to 36 inches of Water; 8 inches to 10 inches is usually preferred.

Lanterns supplied with Single, Duplex, or Cluster of Burners.

TO GAS ENGINEERS AND MANAGERS.

At the Stand on the North Bank of the Kelvin, an attendant will be pleased to give full explanation, and to show the action of the Lamp.

This unique Illustration of Wasted Bye-Products (heat in escaping products of combustion) effecting, without cost, all that is elsewhere reached by special motive power and special distributing Mains, should not be missed,

350 to 500 Candles from a Single Burner, with an efficiency of **35** Candles per cubic foot of Gas.

The ONLY High-Pressure Lamp.

THE LAMPS MAY BE INSPECTED AT ANY TIME BY APPOINTMENT.

THE SCOTT-SNELL SELF-INTENSIFYING GAS-LAMP COMPANY, LTD.,

Telephone No. 559 Westminster.
Works: 29, GILLINGHAM STREET, S.W.

53, Victoria Street,
WESTMINSTER, S.W.

Telephone No.
756 BANK LONDON.

Telegraphic Address:
"ROBUSTNESS, LONDON."

ESTABLISHED 1873.

Contractors to H.M. Government.

RETORT-SETTINGS

INCLINED, REGENERATIVE, GENERATIVE, AND FLOOR LINE.

SEVERAL THOUSANDS OF OUR SETTINGS IN SUCCESSFUL WORK.

Plans, Estimates, and full Particulars for Complete or Partial Erection and Renewal.

J. & H. ROBUS,

Engineering Contractors for Gas and Water Works,

20, BUCKLERSBURY, LONDON, E.C.,

And GORING, OXFORDSHIRE.

GASHOLDER
TANKS.
RESERVOIRS.

MAIN LAYING.
BORING.
WELL SINKING.

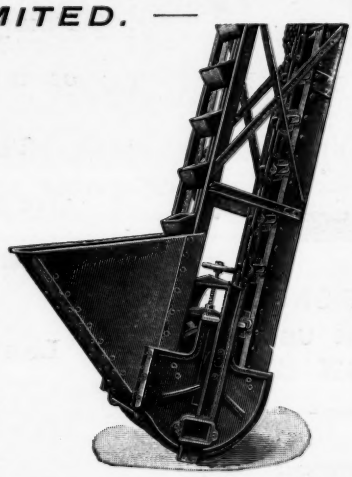
BARRY, HENRY, & CO.,

— *LIMITED.* —

Specialities:

TRANSMISSION
OF
POWER.

Rope and Belt Pulleys,
Spur and Bevel Wheels
Shafting and Couplings,
Pedestals, and Fixings.



Specialities:

TRANSMISSION
OF
MATERIALS.

Conveyors,
Elevators,
Grinding Machinery,
Motors.

WORKS:

ABERDEEN,
SCOTLAND.

AND

64, MARK LANE,
LONDON, E.C.

JONAS DRAKE & SON,

OVENDEN, HALIFAX,

HAVE ERECTED **500** OF THEIR PATENT

TUBE REGENERATOR

FURNACES DURING THE LAST **4** YEARS.

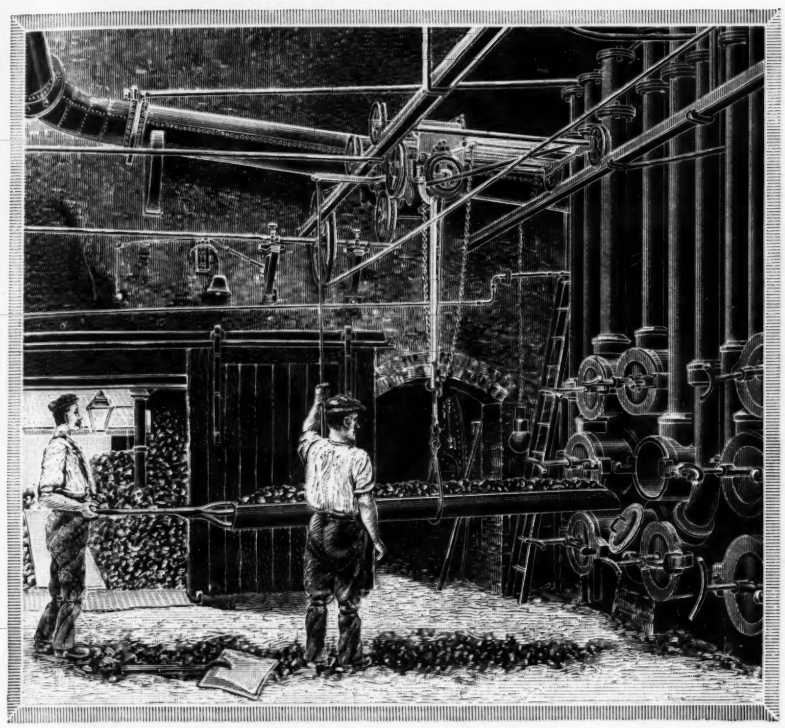
ESTIMATES ON APPLICATION.

Telephone No. 43.
HALIFAX EXCHANGE.

LONDON OFFICE:
34, VICTORIA ST., S.W.

Telegraphic Address:
"DRAKESON HALIFAX."

DON'T ADOPT EXPENSIVE MACHINERY



BUT USE THE PATENT

"RAPID" POWER CHARGING APPARATUS

FOR LARGE WORKS.

Can be seen at work by appointment.

Biggs, Wall & Co.

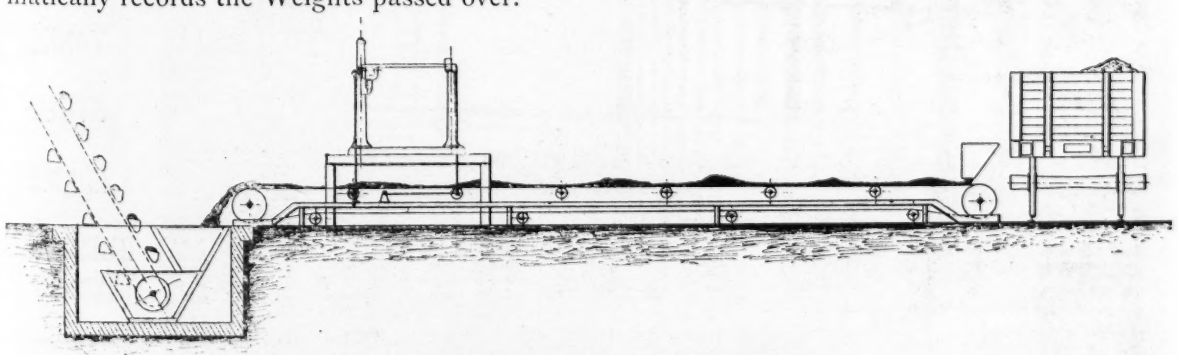
13, CROSS STREET, FINSBURY,
LONDON, E.C.

TELEGRAPHIC ADDRESS:
"RAGOUT, LONDON."

CONTINUOUS COAL WEIGHING & RECORDING.

THE ONLY CONVEYOR WEIGHING-MACHINE IN THE MARKET.

In conjunction with Messrs. Sam. Denison & Son, Weighing-Machine Makers, of Leeds, we have successfully designed a Machine for Weighing Coal, Ores, and other Materials in bulk, while passing on a Conveyor. The Machine weighs accurately, requires no attention, and automatically records the Weights passed over.



THE BLAKE-DENISON CONTINUOUS WEIGHER.

BLAKE, BARCLAY, & CO., VICTORIA WORKS, GREENOCK.

Branch Office: 110, CANNON STREET, LONDON. Head Office: GREENOCK.

Telegrams: "FILTER, GREENOCK." Codes: A1., A.B.C.

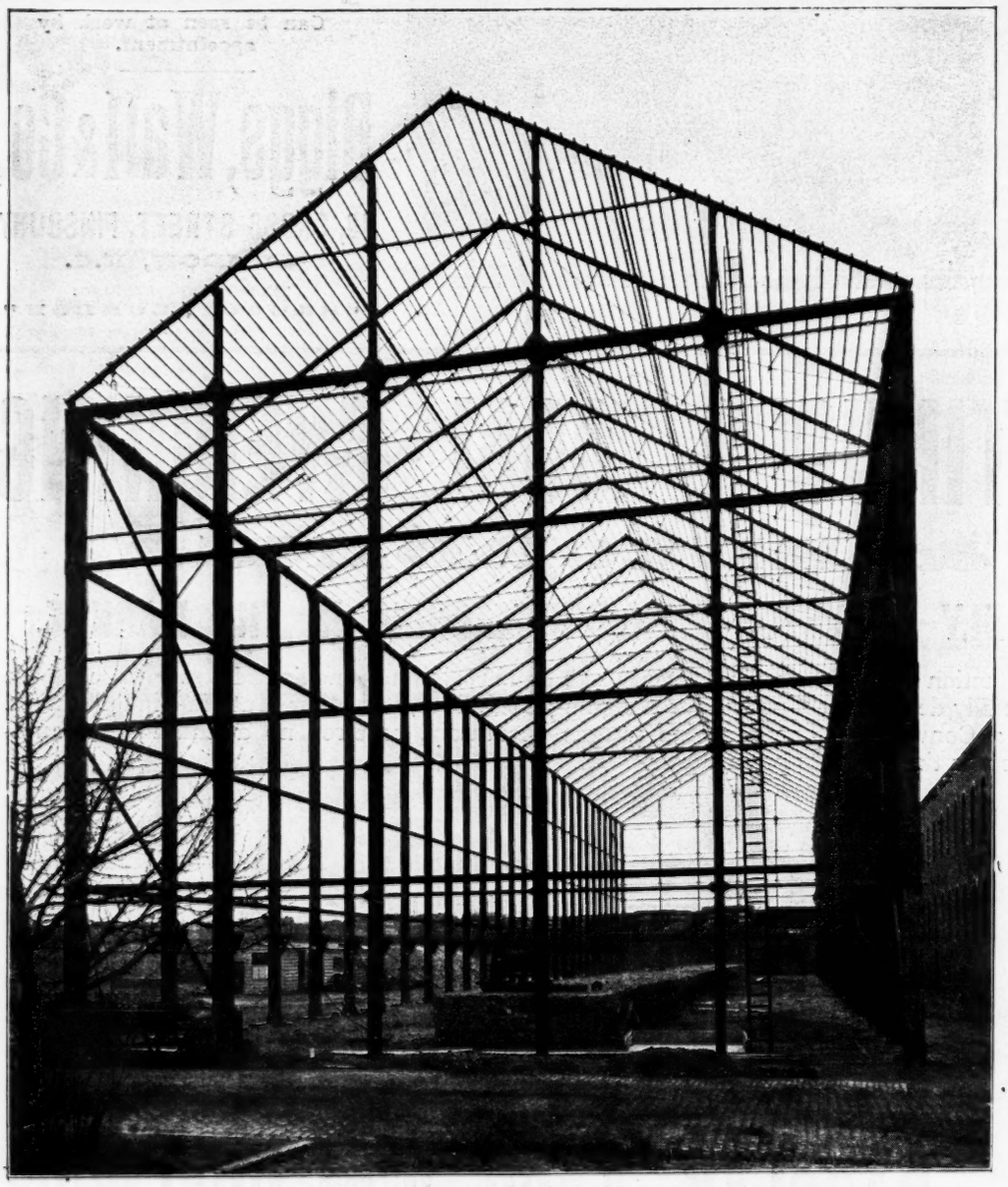
INCLINED RETORTS.

HORIZONTAL RETORTS.

RETORT BENCHES AND SETTINGS,
WITH
GENERATOR OR REGENERATOR FURNACES.

W. J. JENKINS & CO., Ltd., RETFORD.

S. CUTLER & SONS, MILLWALL, LONDON.



EVERY KIND OF PLANT FOR GAS AND WATER WORKS. ROOFS, GIRDERS. TANKS, STEEL-FRAMED BUILDINGS.

STEEL RETORT-HOUSE RECENTLY ERECTED BY MESSRS. CUTLER

GASHOLDERS. CARBURETTED WATER-GAS PLANT. **OIL-TANKS.**

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

Manufacturers of Glasshouse Pots and Crucibles of every kind.
Established 1836.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.
WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

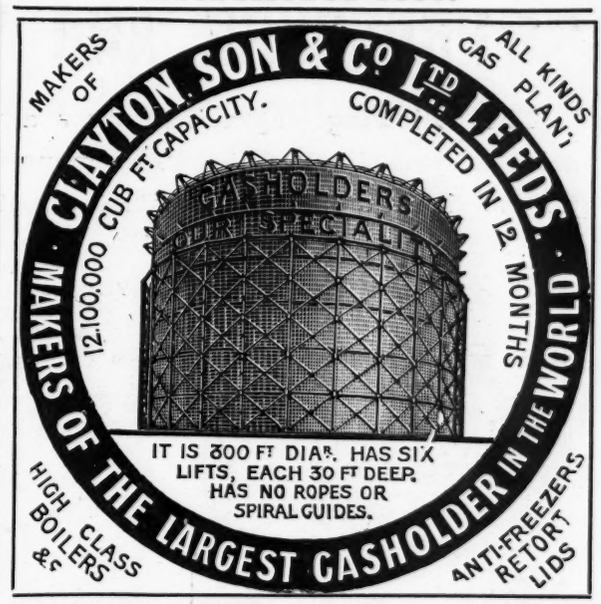
MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.


MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
SPECIALITY
IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

London Office: 60, QUEEN VICTORIA STREET, E.C.
Telegraphic Addresses: "GAS, LEEDS." "ECLAIRAGE, LONDON."

R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone: Nos. 54 and 2296.

OLDHAM ROAD, MANCHESTER.

Purifiers, Superstructure, and Lifting Apparatus erected at the Gas-Works, Northampton.

CONDENSERS, SCRUBBERS, WASHERS, EXHAUSTERS, GASHOLDERS, TANKS, PUMPS, and all kinds of GAS APPARATUS.

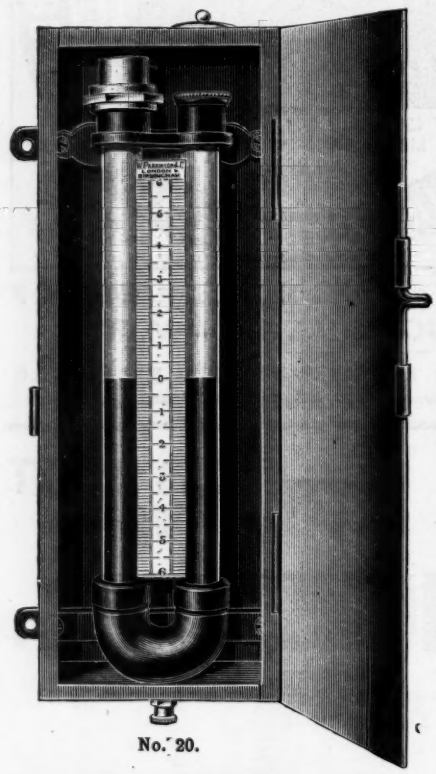
London Office: 165, GRESHAM HOUSE, OLD BROAD STREET, E.C.

PARKINSON AND W. & B. COWAN, LTD.

(PARKINSON BRANCH.)

PRESSURE AND VACUUM GAUGES.

The following engravings show a variety of Gauges adapted for different positions on a Gas-Works. The mountings are either of white metal, brass, or gun metal. We pay the greatest attention both to the finish of the mountings and to the selection of the glass tubes used, while every gauge is thoroughly tested for soundness before leaving our works.



No. 20.

Fig. 2.

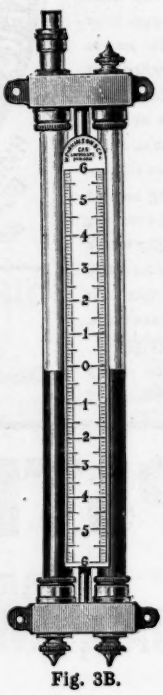
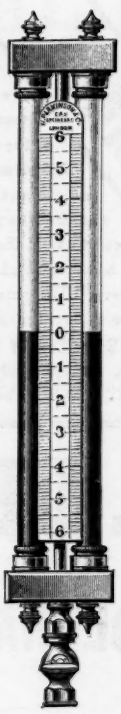


Fig. 3B.

Fig. 1.



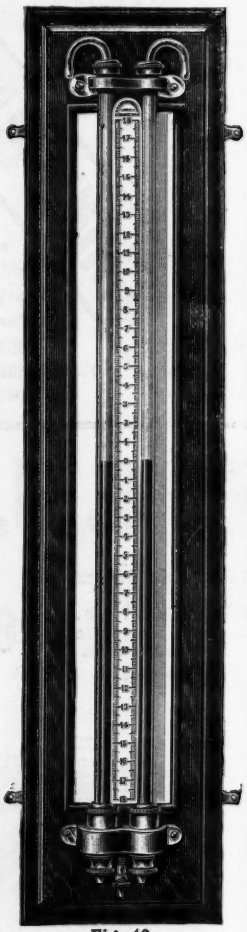
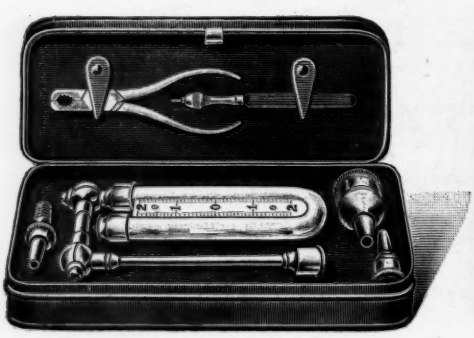
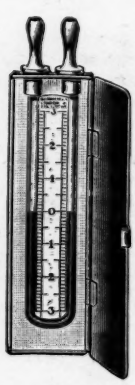


Fig. 10.





No. 30.

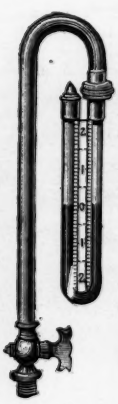
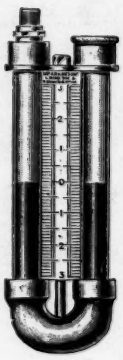


Fig. 6.



No. 28.

Fig. 9.

COTTAGE LANE WORKS, CITY ROAD.

LONDON.

Telegrams: "INDEX." Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,

BIRMINGHAM.

Telegrams: 'GASMETERS." Telephone No. 1101.

[See also Advt. p 1718.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Olding, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 25, 1901.

GENERAL LIBRARY
UNIV. OF MICH.
JUL 1

THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

[REGISTERED AS A NEWSPAPER.

VOL. LXXVII. No. 1989.] LONDON, JUNE 25, 1901. [53RD YEAR. PRICE 6d.

O'NEILL'S OXIDE

Has the Largest Annual Sale of any Oxide in the World.

Registered Telegraphic Address:
"PURIFICATION, LONDON."

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.
JOHN WM. O'NEILL, *Managing-Director,*
PALMERSTON BUILDINGS, LONDON, E.C.

TORBAY - - PAINT.

The TORBAY PAINT CO.,
26, 27, & 28, Billiter Street, London, E.C.
8, India Buildings, Fenwick St., Liverpool.
Also at Brixham & Dartmouth, Devon.

Telegrams: "NEILL, ST. HELENS."
Telephone No. 20 ST. HELENS.

W. Neill & Son,
St. Helens Junction.
PUMPING ENGINES.
SULPHATE OF AMMONIA PLANTS.
IRON AND BRASS FOUNDERS
AIR and GAS COMPRESSORS.

TRADE MARK.

JOHN RUSSELL & CO., LTD.
Established at the Commencement of Gas Lighting.
MANUFACTURERS OF
TUBES & FITTINGS
For GAS, WATER, and STEAM.
STOCKS, TAPS, and DIES.
CHANDELIERS AND BRASS FITTINGS.
Pendants and Brackets for Prepayment Meter Supplies.
HEAD LONDON OFFICE:
145, QUEEN VICTORIA STREET, E.C.
WORKS:
WALSALL, WEDNESBURY, BIRMINGHAM.

PARKINSON AND W. & B. COWAN, LTD.,
Parkinson Branch: LONDON AND BIRMINGHAM.
See Advertisements p. 1718 and last White Page.
Cowan Branch: LONDON, MANCHESTER, EDINBURGH, & SYDNEY, N.S.W.
See Advertisement on Third Page of Wrapper.

THOMAS PIGGOTT & CO., LTD.,
BIRMINGHAM.
MAKERS OF
GASHOLDERS
AND
GAS PLANT.
LONDON OFFICE: 14 GREAT ST. THOMAS APOSTLE, E.C.

CROSSLEY'S
"OTTO" GAS-ENGINE
Crossley's Engines and Pumps
are used in all the most recent and important Towns' Water and Sewage Installations.
LATER PATENTS. MANY NEW IMPROVEMENTS.
CROSSLEY BROS., Ltd.,
OPENSHAW, MANCHESTER.

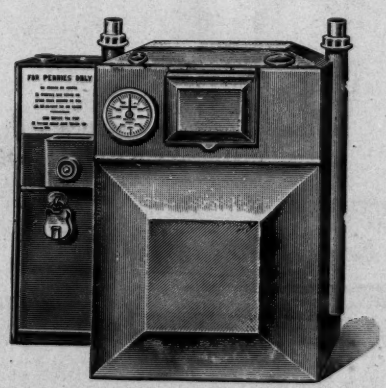
JAMES McKELVIE & CO.,
Cannel & Gas Coal Exporters,
HAYMARKET, EDINBURGH;
and 37 & 38, MARK LANE, E.C.
PRICES AND ANALYSIS
of all the principal
CANNEL & GAS COALS
forwarded on Application.
ESTABLISHED 1840.

L & L
Tubes and Fittings.

LLOYD & LLOYD, LIMITED.
NILE STREET.
BIRMINGHAM.

L & L
Tubes and Fittings.

GEORGE GLOVER & CO., LTD.
(*GEORGE GLOVER, Managing Director.*)



DRY METERS.

MANCHESTER:
138, Princess Street.
Wires: "SLOT."
Telephone: 4628.

LONDON:
Royal Avenue, Chelsea.
Wires: "DRY METERS LONDON."

LEEDS
9, Dewsbury Road.
Wires: "METERS."
Telephone: 2390.

GAS & WATER PIPES. JAMES & RONALD RITCHIE, LTD. (late James Ritchie), ACKLAM FOUNDRY, MIDDLESBROUGH. Telegrams: "RITCHIE, MIDDLESBROUGH."

Telegrams:
"Whessoe, Darlington."

London Office:
106, Cannon St., E.C.

THE WHESSOE FOUNDRY COMPANY, LIMITED, DARLINGTON.

SUPPLY
GAS PLANT OF
EVERY DESCRIPTION
FROM RETORT TO GASHOLDER,
INCLUDING BENCH MOUNTINGS,
CONDENSERS, EXHAUSTERS,
SCRUBBERS, PURIFIERS,
GASHOLDERS AND
TANKS.

MR. THOS. COATES, C.E., MANAGING-DIRECTOR.

ENGINEERS & CONTRACTORS.

Established 1790.

Estimates on Application.

THE GLENBOIG UNION FIRE-CLAY CO. Ltd.

THE LARGEST MANUFACTURERS OF GAS-RETORTS IN GREAT BRITAIN.
FIRE-BRICKS, BLOCKS, &c., &c., for RETORT-SETTING.

WORKS: Glenboig, nr. Coatbridge.
OFFICES: 48, WEST REGENT ST., GLASGOW.

— 42 —
Prize Medals & DIPLOMAS OF HONOUR.
HIGHEST AWARD wherever exhibited.

The SPECIAL BRICKS used in the Construction of Gas Furnaces now being introduced for Heating Retorts.

The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

SIMMANCE & ABADY'S
RAPID READING PHOTOMETER for WATER GAS (replacing the Jet).

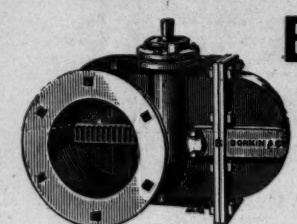
SIMMANCE & ABADY'S
PATENT CALORIMETER, £8 8s. 0d. complete.

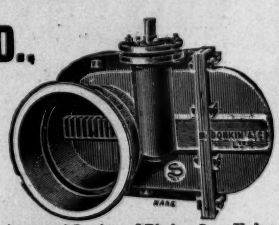
SIMMANCE & ABADY'S
PATENT FLASH TORCH for ABOLISHING the BYE-PASS in INCANDESCENT STREET LIGHTING.

NOTE—This latter is not a mechanical contrivance. *The Torch does not come within 6 inches of the Mantle or Burner.*

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER, S.W.

BRYAN DONKIN & CLENCH, LTD.,
ENGINEERS, BERMONDSEY, LONDON, S.E.
Head Office: AS ABOVE. Works: BERMONDSEY & CHESTERFIELD.
ORIGINAL MAKERS OF THE
INTERNAL RACK AND PINION GAS-VALVE IN 1847


Internal Rack and Pinion Gas Valve (Flange.)


Internal Rack and Pinion Gas-Valve (Spigot and Socket).

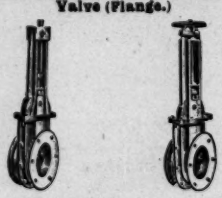
Large Stocks kept. Prompt delivery.

All tested to 30-lbs. pressure. Pinions of forged Steel.

Over 100,000 now supplied.

Teeth cut out of the solid. All Valves fitted with Patent Volute Springs.

Rack and Pinion Gas-Cock


Outside Rack and Pinion Gas-Valve. Fig. 8.

Outside Screw Gas-Valve Fig. 18.

Internal Worm & Rack Valve & Column. Fig. 33.

Internal Rack and Pinion Valve and Column. Fig. 30.

Self-Acting Bye-Pass.

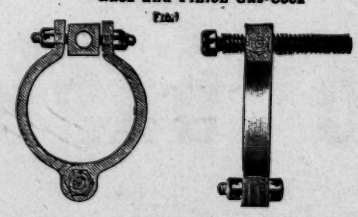
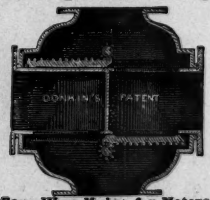
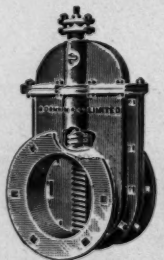


FIG 2.



Four-Way Valve for Meters, Governors, Purifiers, &c.

HELPS' PATENT PIPE-EXTRACTOR.

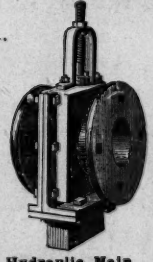

Worm and Rack Valve. Fig. 26. C,19c.

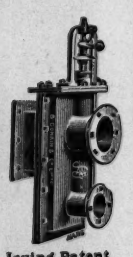
Water-Valve, for 200-lbs. pressure.

MANCHESTER OFFICE:
Mr. Henry Thomas, 10, Mawson's Chambers, Deansgate.

ALSO MAKERS OF APPARATUS FOR THE CONTINUOUS DISTILLATION OF AMMONIA.

Our EXHAUSTERS are largely used in connection with WATER-GAS PLANTS, and are giving every satisfaction. We are constantly receiving repeat orders.


Hydraulic Main Seal Regulating Valve. Fig. 24.


Irving Patent Regulating and Flushing Valve.

SAFETY OR BYE-PASS GOVERNORS

One of the most serious mishaps which can occur in the working of Gasholders is the accidental shutting-off of the Gas Supply to the district, through forgetfulness on the part of the Valveman to open the outlet of a Second Holder before he closes the First. Nor can this contingency be obviated by any system of working which depends upon the attendant's agency for carrying it out. The difficulties are increased when the Gasholders are manipulated in the manner best calculated to satisfy the Consumers as regards regularity in Illuminating Power—*i.e.*, by working into one Holder and out of another, reversing the operation when necessary, and thus giving the varying qualities of the "make" the opportunity to mix before they are sent into the district.

Our **SAFETY BYE-PASS GOVERNOR** has been designed as an absolute safeguard against any interruption in the town supply. It is fixed in any convenient position between the Outlet of the Station-Meter and the Inlet of the Governor, and is so arranged as to come into action the moment the Pressure on these falls below that given by the lightest Gasholder. When once set, the apparatus cannot be interfered with; and it may also, if desired, be completely enclosed.

We have supplied these **SAFETY GOVERNORS** to a number of Gas-Works, and shall be pleased to furnish a list of same to those who may favour us with inquiries.

PARKINSON AND W. & B. COWAN, LTD.

(COWAN BRANCH),

SMITH SQUARE WORKS, WESTMINSTER,	DALTON STREET WORKS, NEWTOWN,	BUCCLEUCH STREET WORKS,	COLONIAL METER WORKS, MACQUARIE PLACE,
LONDON, S.W.	**MANCHESTER.**	**EDINBURGH.**	**SYDNEY, N.S.W.**
TELEPHONE No. 250 WESTMINSTER.	TELEPHONE No. 1843.	TELEPHONE No. 733.	TELEPHONE No. 2320.
"DISC, LONDON."	"DISC, MANCHESTER."	"DISC, EDINBURGH."	"DISC, SYDNEY."

TELEGRAPHIC ADDRESSES:

Telegraphic Codes used. A1 and A.B.C. 4th Edition. Special Code furnished on application.

THE GAS METER COMPANY, LIMITED.

Works: LONDON, OLDHAM, DUBLIN.

See also Advt. page 1714

MANUFACTURERS OF EVERY DESCRIPTION OF GAS-METERS.

See also Advt. page 1714.

THE COMPANY MANUFACTURE TWO KINDS OF

PREPAYMENT METERS.

1st. VALON'S PATENT STOP METER.

2nd. THE "MUTUAL" COIN PENNY-IN-THE-SLOT METER.

WITH LEVER ON TOP OR SIDE AS PREFERRED.

MADE TO TAKE PENNIES, SHILLINGS, OR ANY FOREIGN COIN.

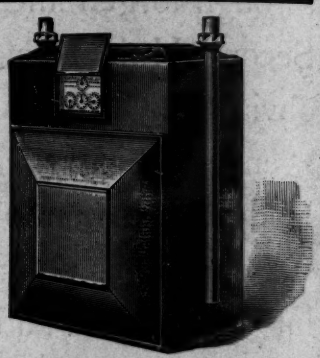
For Prices and Particulars, apply to

F. W. CHURCH, Secretary, 238, KINGSLAND ROAD, LONDON.

WET & DRY GAS-METERS

OF

THE FINEST QUALITY.



D. BRUCE PEEBLES & CO.,

TAY WORKS, EDINBURGH.

WEST'S GAS IMPROVEMENT COMPANY, LTD.

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER;

AND 104, QUEEN VICTORIA STREET, LONDON, E.C.

MAKERS OF WEST'S MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS.

WEST'S PATENT REGENERATOR SETTINGS.

WEST'S PATENT SILENT COKE CONVEYOR.

RETORT MOUTHPIECES WITH SELF-SEALING LIDS.

THE DELLWIK-FLEISCHER WATER-GAS PROCESS

For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

(PATENTS IN ALL COUNTRIES)

Plants contracted for within the last Eighteen Months for the following Gas-Works: WEST BROMWICH, KÖNIGSBERG ISERLOHN, LYONS, ERFURT, REMSCHEID, PFORTSHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG, BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG.*

[* Blue Water Gas with Incandescent Burners.]

ALSO TWENTY-SEVEN INSTALLATIONS FOR MANUFACTURING PURPOSES.

THE DELLWIK-FLEISCHER WATER-GAS SYNDICATE,

25, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

London: Printed by Walter King (at the Office of King, Sell, and Olding, Ltd., 12, Gough Square): and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 25, 1901.